SEXTANT

New Column: BASIC Questions and Answers

$2.95
September-October 1985
Issue No. 18

The Independent Magazine for Users of Heath/Zenith Microcomputers

The Quest for the Ultimate Word Processor

CP/M Reads Foreign Disks

Weighing the Merits of the Z160

SigmaSoft's Interactive Graphics Controller for the '89

Modify HDOS to Run MBASIC Programs From a Menu

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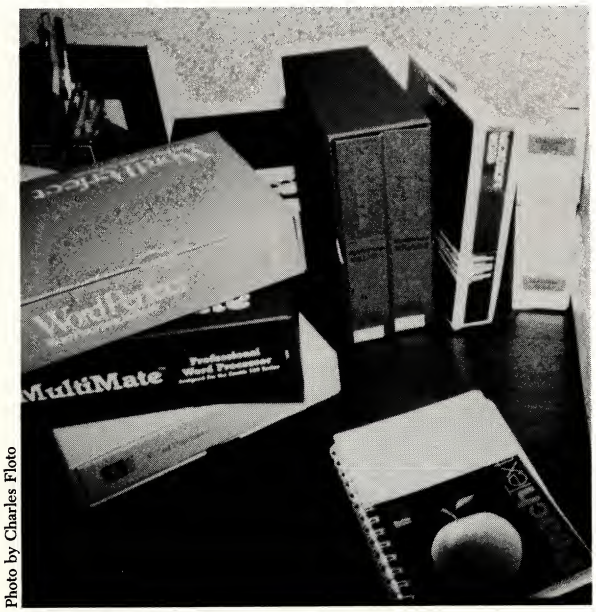

Photo by Charles Floto

17

There is no consensus on Z100 word processors. If you're trying to pick one, it seems that everyone you ask recommends a different one: WordStar, PeachText, WatchWord.... Our author doesn't have a favorite, either. He's tried them all (well, most of them), and he's still looking. In the process, though, he's gotten to know them all pretty well. His findings and opinions should be helpful for the rest of us.

Features

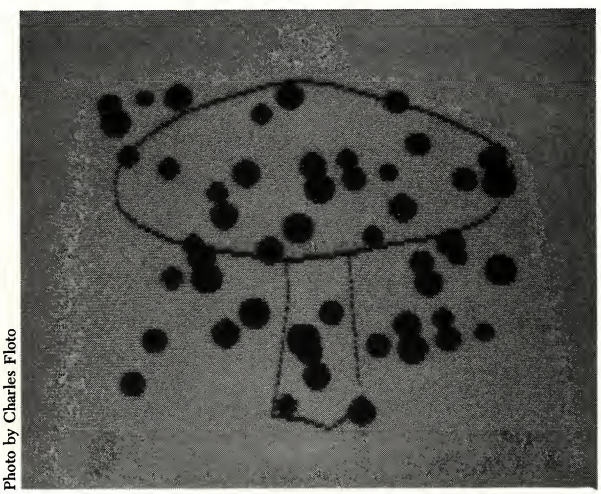

Photo by Charles Floto

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It's not always easy to achieve a desired graphics effect in Z-BASIC. Sometimes you have to do a bit of preparatory work before you can assemble the final product. How to do this is just one of the topics covered in Ed Byrnes' first column on BASIC programming.

Issue #18
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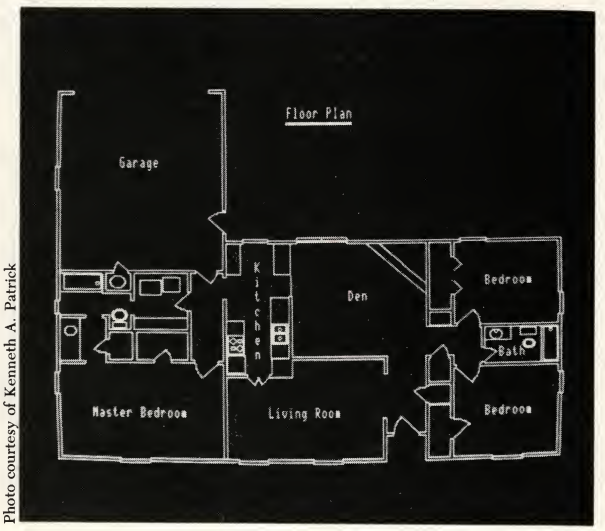

Photo courtesy of Kenneth A. Patrick

49 Is the siren song of high-resolution graphics threatening the future of your '89? Several graphics boards are available for the '89 which improve its resolution. Last year, SigmaSoft and Systems introduced their Interactive Graphics Controller. It gives you more than just 640 x 250 pixel resolution. It gives you 64K of RAM (which you'll need for the graphics), RAM disk software, and two parallel ports.

Departments

Cover photo by Charles Floto

The Editorial Eye

In my last editorial, I noted some of the more interesting results of a survey of *Sextant* subscribers conducted by McGraw-Hill Research. Since then, I've done a bit of analysis of the responses to another question: "Please rate each of the following elements of *Sextant* for their importance to you, and for their quality, based on the scales given." The answers to this question could be quantified in several different ways. The clearest conclusion is the rather unsurprising one that *Sextant* subscribers find the articles its most important feature.

Beyond that, the results are open to more than one interpretation. My weighting of the responses put the table of contents in second place for importance, with advertising ranking third. The Reader Service Cards came next. "Letters" and "Standard Operating Procedure" were pretty close to a tie for fifth place in importance. The next three features finished even closer together in importance: the plastic wrapper used for mailing, "Supplier Notes," and "Scuttlebutt." According to my analysis, all these received a rating of importance above the average.

The "Index to Advertisers" came in just a tad below the average rating for importance. "The Editorial Eye" finished in eleventh place—a slight consolation for me, as I'm fond of the number 11. The ranking of the three least important elements of *Sextant* didn't seem subject to much dispute. "Classified Ads" came in ahead of the front cover, with "Luminaries" judged least important of the 14 listed.

The elements of *Sextant* which a random sample of our subscribers were asked to rate can be divided into two groups. *The parts of the magazine created by our staff account for seven of the eight least important elements. Four of the six most important elements originate outside our office.* These include articles—the most important—as well as "Letters" and "Standard Operating Procedure." Since both *Sextant* subscribers and staff consider letters from readers important, we'd like to hear from you.

Coming up with *quality* rankings for the elements of *Sextant* listed in our survey of subscribers involved more decisions. The first choice I made was to include the responses of only those subscribers who considered a given element either "Very Important" or "Somewhat Important." For example, the 18% of survey respondents who rated "The Editorial Eye" as "Not Important" did not have a chance to influence its quality ranking.

Once again, the winner was clear. The element of *Sextant* exhibiting the highest quality was judged to be the plastic wrapper used on copies mailed to subscribers. It was rated "Excellent" by two-thirds of those survey respondents who considered it of any importance (23% didn't). So those *Sextant* readers who don't subscribe are really missing out on something.

The other elements of the magazine with above average quality ratings were bunched fairly close together in my ranking: Reader Service Cards, articles, the table of contents, "Index to Advertisers," and the cover.

The subscriber surveys we conduct every couple of years are valuable guides for the staff of *Sextant*. They provide a context for evaluating both our own notions and the comments we receive from readers. But they're no substitute for fuller and more personal communication. The latter has led to such innovations as the symbol now used to mark the end of an article and the binder interface kits described on page 100.

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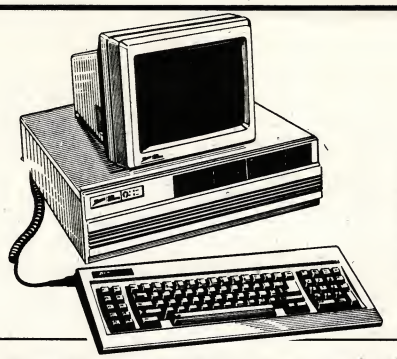

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Letters

Pass Variables With ALL

I am happy to say that I enjoyed your May-June issue of *Sextant*. Your magazine contained many interesting articles. Of course, being an H89 owner, I enjoyed your articles pertaining to the H89 especially.

I would like to mention that in the article "Passing Variables with CHAIN and COMMON," by Robert A. Hanan, M.D., he stated "If ALL is used without the line number, no variables will be passed to PROG2." This is not the case, for if you specify the statement as follows:

```
CHAIN "PROG2",,ALL
```

then all variables will be passed to PROG2. Notice that you must specify the two commas to show that you do not wish to specify the line number.

Michael S. Stevens
Loveland, OH

Key Repeat Won't Work . . .

About a year or two ago I saw a magazine article with an auto-repeat key description. I started to round up the parts and install it in my H19, but I moved and did not get around to it until just recently. In the move I lost the magazine. So I was pleased to see just what I wanted in the July-August 1985 *Sextant*, "Add Automatic Key Repeat to Your '89 or '19," by Ray Albrektson.

This time I got all the parts, hooked them up, and sure enough it did *not* work. I studied the circuit and measured the voltages. They do not conform to the discussion in the article. I do not see how it will work. The key contact voltage changes from a negative four volts to a negative five volts on my H19. I tried different relative grounds, but no success. My version H19 does not have a U101 or ground lug as indicated in the article. Since I am not an expert in electronics, I have come to an impasse. I would appreciate some help, if possible.

Some points of interest on this project which may contribute to my problem and help others: First, there is not much clearance under the keyboard. My miniature potentiometer was too big to fit as described in the article, so I moved the small circuit board up to the wider end of the keyboard and mounted the diode lug on it. Second, I am not sure about the capacitors. The schematic calls for the 22pf capacitor at C1, but comparing Figure 3 to Figure 5 the ceramic and electrolytic capacitors are reversed. Finally, the schematic, Figure 2, has a typo. The output of U1c should be pin 4, not pin 7.

Jerry B. Callahan
9107 Don Mills
San Antonio, TX 78250

. . . Without Some Changes

I am writing in regard to Ray Albrektson's article in the July-August issue of *Sextant*, discussing the addition of an automatic key repeat feature to H89s and H19s. The circuit, as designed, appears marginal in performance, as it wouldn't work properly on my H89. Another possibility is Heath's usage of different ICs on versions of the CPU board. (The repeat function is controlled by U435, versus U446 in the article.)

The major problem appears to be the output interface characteristics of the CMOS 4011 IC, which cannot drive the TTL IC #U435 (7404 hex inverter) in my H89. The 4011 evidently cannot bring the 12 volts, through two paralleled 10-Kohm resistances, low enough to activate the inverter.

I was able to make the circuit work by adding a 74C902 CMOS/TTL buffer between the 4011 pin 4 and the input of the 7404. That buffer IC just happened to be in my parts box and would not be a recommended modification for someone just starting the project.

A better method would appear to be modification of the circuit to utilize a 4049 IC, which is also CMOS but is rated to drive two TTL inputs. I have attached a circuit diagram (Figure A) which should do the trick. Unfortunately, due to inherent laziness on my part, I haven't tried it, as I already have a working circuit.

Tom Clydesdale
Pittsburgh, PA

Out of Step

Mr. Rick Downer's remarks about using up 3.75 pages on Microsoft Word ("Letters," May-June 1985) are out of step with what is going on in the modern world. In the May-June issue of *Sextant*, there are approximately 100 ads; 60% of the ads feature products for all Heath/Zenith equipment, or are directed to the '150 (MS-DOS) user. Of the current products being offered by Zenith for retail consumption, 90% are in the '150 category. Each issue of *Sextant* has more and more ads pointed to the '150 user. Mr. Downer, it's the ads that enable the magazine to be published; the magazine will grow in the '150 category, thus more ads and articles for the '150s.

I own both a '122 and '152 Zenith, and have been a *Sextant* reader for the past three years. I bought the '152 because of

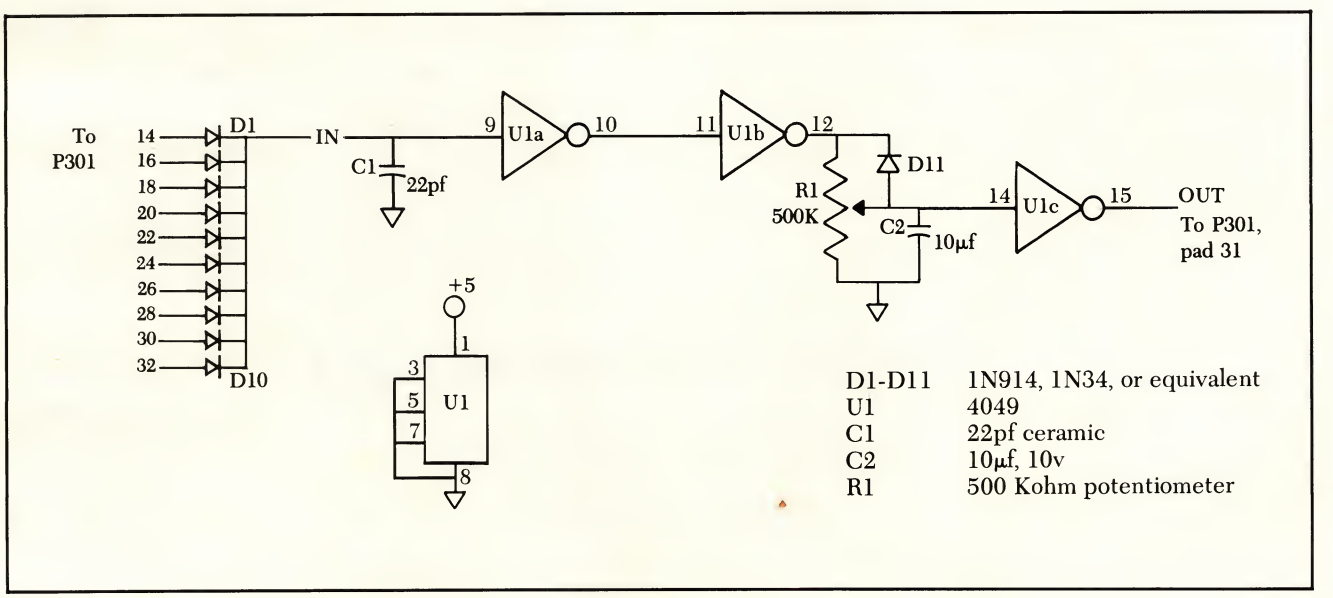

Figure A.

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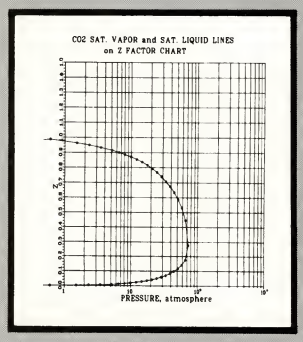
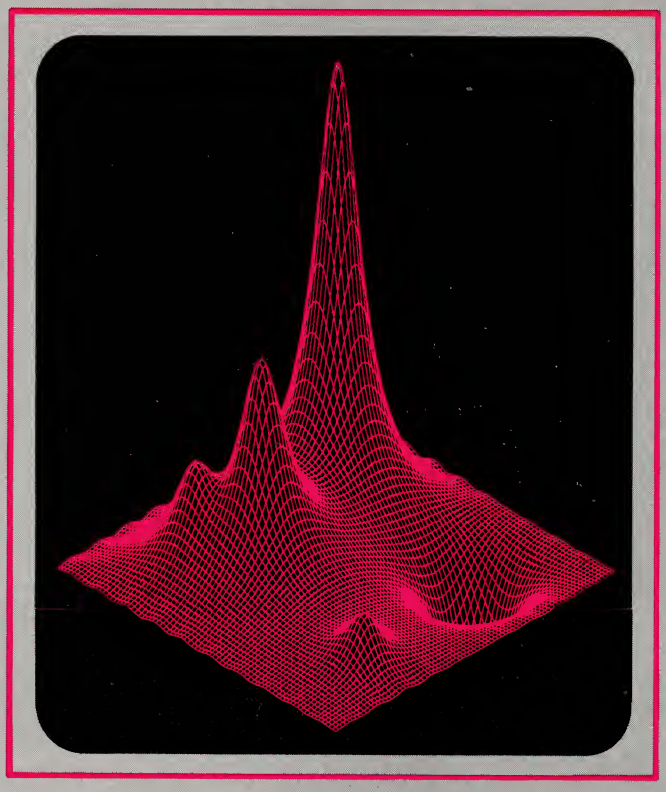
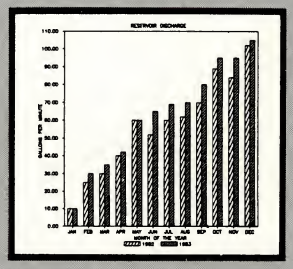


Scientific Plotting

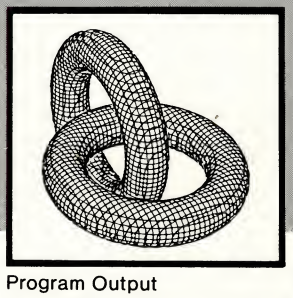
Symbol Sets



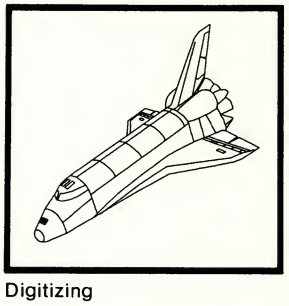


Business Graphics

Contouring



Program Output



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Circle #143 on Reader Service Card

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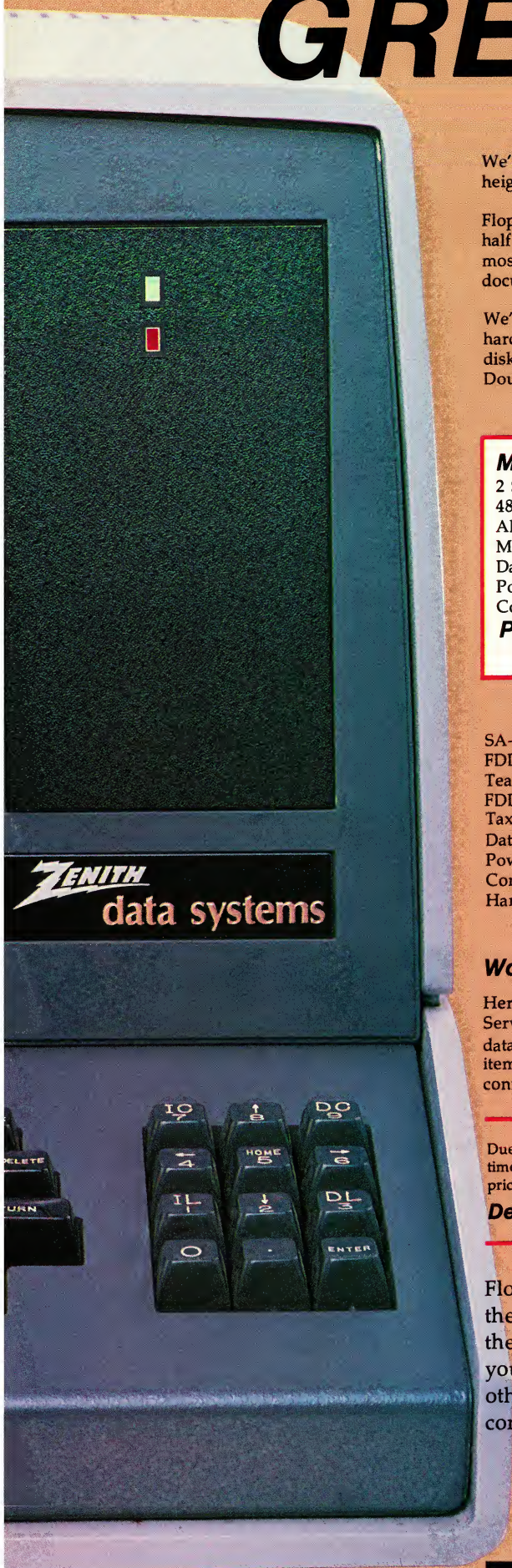

The H89 TWOET systems Just Got Hard to beat!

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We've thoroughly tested the TWOET/Heath set-up. And now by popular demand, the new 10 megabyte hard disk system! We are now able to offer you the storage you want and need for a fair price! The hard disk system comes with all software needed to run with the 17 or 37 controller and/or the Magnolia Double Density controller.

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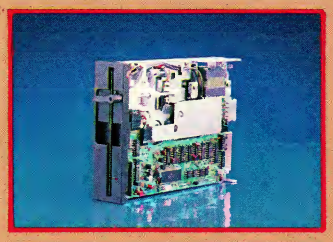

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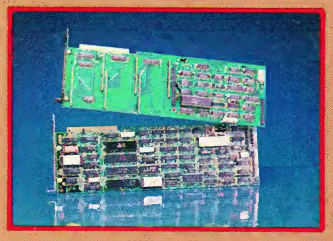
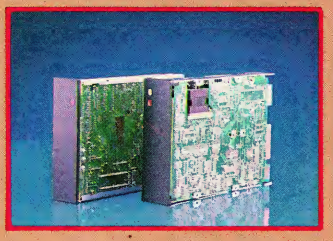


SA-712 & MicroScience

Half height 10 megabyte (20mb available soon) hard disk drives. The MicroScience has a plated media and is available with a full size bezel option. The Shugart has an on board low current option and is backed by a one year warranty. It also has a full size bezel option. both drives are available for the H/Z-89, H/Z-150, H/Z-160. $525.00 each.



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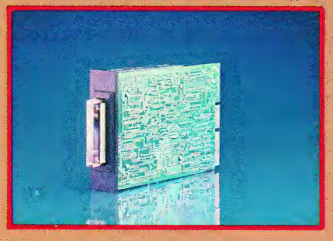

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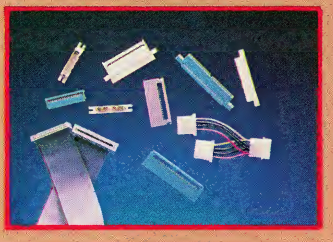

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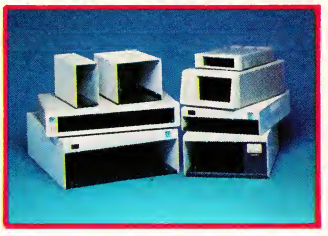

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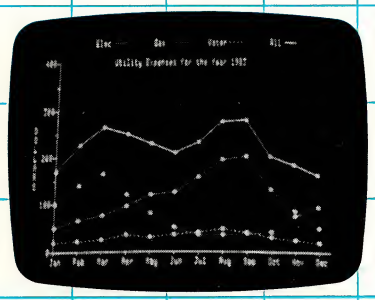

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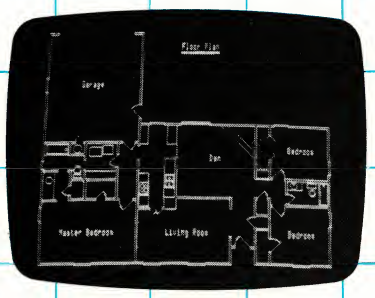

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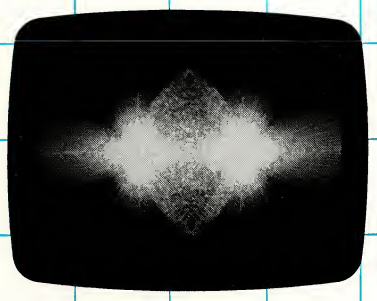

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Scale	x,y
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Print	page
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Get	x,y
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An Example in BASIC:

10 PRINT CHR$(1);"Dot",X,Y

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Jim Kaplan
Northbrook, IL

Go Off Line With Pascal

William Hall's OFFLIN assembly-language program in the July-August issue (#17) surely fills a need, but there is an easier way for those of us with Pascal. The program in Listing A does exactly the same thing.

Note that I read from KBD, which is the non-echoing input device.

Walter I. Hess
Schaumburg, IL

ZSTEM Now Runs at 8 MHz

In the article by Wayne Rash, Jr., in *Sextant* #16 ("Speed Up Your '100 50%"), he mentions that ZSTEM will not run in 8-MHz mode.

This problem was corrected with version 1.6.8 which we commenced shipping in November 1984.

Our policy is that anyone with version 1.6.7 is entitled to a free upgrade to version 1.6.8. Owners of older versions can upgrade to the latest version for US$20.

We ensure that our software will run with all Zenith hardware and software releases. We try to accommodate third-party add-ons as feasible.

The latest release of ZSTEMpc-VT100 for the Z100 PC (Z150) series will run on the IBM and Zenith AT (Z200) systems with the monochrome, graphics, or enhanced graphics adaptors.

Eric Alexandre
KEA Systems Ltd.
Suite 412, 2150 West Broadway
Vancouver, B.C., Canada V6K 4L9

Imaginator Gathering Dust

I found the article about the Imaginator which starts on page 25 of *Sextant* #16 ("Great Graphics on the '19 and '85") to be interesting. Especially since I own one which is sitting on a shelf gathering dust.

The problem is that I have an Ultra ROM installed in my H89 and it is an important part of the interface with a Most Accurate Clock. It was not until I had installed the Imaginator that I learned that it is not compatible with the Ultra ROM. My choice, it seems, is to use one or the other.

Some time ago I wrote to Software Wizardry to find out if there might be some way to patch Ultra ROM to gain compatibility. So far I have not had a reply.

Now I wonder whether there might be a *Sextant* reader who would know the solution to my problem.

Robert F. Hassard
3466 Tice Creek Drive, #4
Walnut Creek, CA 94595

Use PROMPT to Silence Keyclick

Over the past several months, I have noticed many letters, articles, and comments regarding the sending of ESCape functions to the Z100 terminal.

The problem is quite simple when running with MS-DOS. I use the PROMPT command and the characters as shown in the Microsoft MS-DOS manual. I place the command in an AUTOEXEC.BAT file. (The following information was not included in the Zenith manual; however, the PROMPT variations seem to be fully supported.)

Example: PROMPT $ex2$em40ng sets the terminal to "key click off" (ESC x 2); the color to green (ESC m 40); and the prompt to "A>" or "B>" (ng).

When in the MS-DOS operating system, ESCape functions can be sent to the terminal any time from the keyboard.

Edward R. Walker
Seabrook, NH

Correction

An incorrect phone number was given for The Software Toolworks on the "Letters" page in the July-August issue. The correct number is 818/986–4885.

Processing of *Sextant* reader service cards sent in for the May-June 1985 issue was delayed by *Sextant*'s outside data processor. We regret any inconvenience caused to our readers and advertisers, and have taken steps to see that this will not happen again.

```
PROGRAM OFFLIN;

VAR
  CH : CHAR;

BEGIN
  WRITELN('Welcome to OFFLIN.');
  WRITELN('Type CTRL-\ to exit.');
  REPEAT
    READ(KBD,CH);
    WRITE(CH)
  UNTIL ORD(CH) = 28
END.
```

Listing A.

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DEC VT180 (SSDD)
Davidge (DSDD)
Digilog (DSDD)
Epson Multifont (DSDD)
Epson QX-10 (DSDD)
Fujitsu Micro 16s (DSDD)
Groupil III CP/M (DSDD)
H/Z Z-100 CP/M (DSDD) - later
H/Z Z-100 CP/M (SSDD)
H/Z Z-100 Z-DOS 1.xx (SSDD)
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H/Z Z-90 40 trk, 2 k blk (SSDD)
Heath w/Magnolia CP/M (SSDD)
IBM PC CP/M-86 (DSDD)
IBM PC CP/M-86 (SSDD)
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ISM CP/M (DSDD)
Insight Dev. IQ-120 (SSDD)
Kaypro II/2 (SSDD)
*Kaypro 4, 10 (DSDD)
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Navy Micro '85

The Z100 is still on active duty.

Bryan M. Rutberg

The Navy Micro/OA conference is sponsored by the Navy Regional Data Automation Center (NARDAC) in Norfolk, Virginia. The conference purpose is to educate the Navy, Department of Defense and other government agencies in the capabilities and potential uses of microcomputers....

—Official Show Rules

The Navy's 1985 microcomputer and office automation conference ran from May 20-23 in the resort town of Virginia Beach, Virginia.

Nearly one hundred "focus" sessions, seminars, and product briefings were held, and about 75 computer and computer-support companies (including Sextant Publishing Company) were on hand to display their wares. The sessions all seemed to be well attended, but traffic through the exhibition area was light, if fairly steady, during the three days it was open.

As with the Air Force Small Computer Conference last October, the "big guy" wasn't "Big Blue," but Zenith Data Systems (ZDS). (See "Heath/Zenith Dominates Air Force Small Computer Conference," by Mark Goodkin, *Sextant* #14, January-February 1985.) Much of the conference conversation concerned Zenith's newly announced extensions to their IBM-compatible line, and the loss of what could have been Zenith's third major contract to supply the Navy with microcomputers.

D.E.L. Professional Systems' Gemini emulator board, which finally had its public unveiling, also caused quite a stir among attendees. The board allows the Z100 to run software written for the IBM Personal Computer.

Zenith dominates show

Evidence was abundant that the contracts between Zenith and the Navy have been successful. Numerous Z100s and Z150s adorned exhibitor booths, and NARDACs from around the country that offered free software made copies on their Z100 or Z150—often both.

Zenith Data Systems certainly had the busiest booth in the place. Uniforms were trying out the new light-weight portable Z171, examining the IBM PC AT-compatible Z200, and adding the 8-megahertz Z158 (a Z150 with a speed-up switch) to their wish lists. In contrast with their exhibit at COMDEX earlier in the month, ZDS was also showing the Z100, both in their booth and in their hands-on room. Apparently they'll trot out the '100 for military shows and regional and national HUG conferences, but not for the "general public."

Zenith beat out by "inventive" pricing

Zenith's new Z138 portable IBM-compatible machine (about 15 pounds lighter than the rather hefty Z160) received a great deal of attention as well. It was the Z138 that Zenith included in its recent proposal to supply the Navy with portable microcomputers. The Navy expects to purchase up to 36,000 portables in the next three years. Losing the contract to Seequa Computer Corporation was a blow to ZDS, since they believed that they were able to provide the highest quality machine.

There was, as might have been expected, an "untold story."

For some reason, when the Navy requested bids for this contract, they put out an Invitation for Bid (IFB) rather than a Request for Proposal (RFP), which is far more common for this type of contract. It was Zenith's response to the more rigorous RFP which had won the Z100 and Tempest Z150 contracts. (Tempest machines are high-security versions of everyday machines, designed not to radiate any frequencies which could carry sensitive information.) An Invitation for Bid is more commonly used for such "hardware" as paper clips and staplers, and thus the most heavily weighted factor in awarding a contract is price.

Zenith got beat because Seequa came through with a "better" price (or rather, a more attractive pricing structure). While Zenith offered a fairly low price for each unit sold over the course of the three-year contract (somewhere just under $1,000 per unit), Seequa proposed a more inventive method of pricing. The first four months of the contract will see their portable priced at $1,435, or roughly 45% higher than the Z138 would have cost. But Seequa figured in a descending price scale, which will see the portable's price tag fall to $1,254 for the rest of the first year. Then the price drops to $864 for the second year of the contract, and finally to an astonishingly low $450 in the last year.

Simply, Seequa appears to be betting that the demand for portables will be highest when the contract first goes into effect in September of 1985, and that they will get most of their sales when the price is highest. As years pass and new technology is available, demand should drop, and they'll sell fewer computers at the low end of the price scale. But they won the bid because the Navy based their calculations on an even distribution of the units over the next three years. No weight was taken away from the later, lower prices, which may be for technically obsolete machines.

Though there had been some talk of a challenge in the form of a formal protest, Andrew Czernek, Zenith's director of marketing, claimed that no such protest would come from ZDS. Rather, he suggested, they'll try to outflank Seequa. Zenith is planning to add the Z138 to its contract with the General Services Administration, and they expect that in situations where purchasing from the Seequa contract is not mandatory, they will pick up a good deal of business during the next couple of years.

Gemini board's public debut

The other big news at Navy Micro was better for Zenith. Ed Dolejsi, president of D.E.L. Professional Systems, was in attendance with Peter Van Baarsen, who was closely involved with the development of the much heralded Gemini emulator board. Both were receiving the curious in Zenith's hands-on room, where they were publicly displaying the board for the first time. And the reviews at the conference were as enthusiastic as some of the personal thoughts which have been shared in *Buss: The Independent Newsletter of Heath Co. Computers*, and on the Heath Users' Group bulletin board. With the wide array of software being used at the conference, the board had every opportunity to be tripped up, but it ran everything people brought in.

Naturally, this caused quite a stir, and in order to lessen the crowds in the hands-on room, NARDAC Norfolk hastily arranged to use a larger room for the formal product briefing on Tuesday morning. It was quite a draw. Dolejsi

and Van Baarsen spoke briefly about some of the technical considerations which went into the making of Gemini, but mostly were kept busy answering questions. The question I think was most asked by Z100 users during the course of the conference was, "When can I get my Gemini board?"

One note concerning Dolejsi's timing: Tuesday, May 21, the date of the product briefing, was the first day of the zodiacal sign Gemini, the twins.

The H/Z bandwagon

Plenty of other vendors were touting their Heath/Zenith-specific products. Old hand Software Wizardry had a booth. They were showing their popular P-SST (Programmable Sound, Speech and Time) board, as well as new programs Whiz and UMenu for the Z100. Whiz is another variation on the theme of RAM-resident utilities, and was attracting some attention from "power users." UMenu is a menu-interface program.

Multimate International Corp. was displaying their IBM Personal Computer version of the MultiMate Professional Word Processor, which they've recently adapted to run on the Z100. This places them in a good position to capture some lucrative military business. Zenith compatibility was touted by many other vendors—it was a pleasant change.

Two items not every user needs, but which are especially useful for the Navy and Air Force, were on display. One was Anchor Pad Security Systems' "Anchor Pad," which locks a Z100 or Z150 to a desk without any bolts through the furniture or internal modifications to the machine. The other was Systems Management American (SMA) Corporation's "ruggedized" version of the Z100 and Z150. Dust protectors over the disk drives, extra fans and filters, and some internal modifications make the computer able to stand the rigors of field work. And they do mean "field" work.

For the computer novice, Computer Dynamics, Inc., offers instruction in the use of Zenith micros with popular software packages. CDI also showed off their local area network for the Z100, IBM Personal Computer, and compatibles such as the Z150.

Indeed, Zenith's name was all over the place. Complimentary copies of the April issue of *Chips Ahoy: A Navy Small Computer Newsletter* featured cover stories on Z150 hardware and software, and an evaluation of the Tempest Z150. Inside was the first appearance of their new Z100 column, called "Z-Corner." And every software review began by identifying the Zenith machine(s) on which the programs ran.

At the seminars

In the two main Zenith-specific seminars, attendees learned more about Zenith's new machines, modifications to the current Z100 and Tempest Z150 contracts, and terminal emulation programs available to Zenith users. Wednesday afternoon, Patrick Gallagher, ZDS federal-accounts manager, spoke at a seminar that was supposed to cover the Z100 and Z150. But it ended up including all the new machines as well (and maybe one that hadn't even been announced yet).

The big news about the new machines has already been covered in these pages and others. (See *Sextant* #17, July-August 1985, "ZDS Introduces Five New Computers.") But some new insights and emphasis were given by Gallagher. He pointedly remarked (smiling all the while) that the portable Z138 would be on the GSA list of approved computers, underselling the Seequa machine. He replied to a questioner that the AT-compatible Z200 would not be offered in kit form, unless there was some unforeseen demand for such a kit. The Z200, he explained, is primarily intended for the office user, who will most benefit from the multi-user Xenix environment; Zenith's expectation is that orders for office use won't lend themselves to kit popularity.

The Z171 light-weight portable, the Z148 "entry level" IBM compatible, and 8-megahertz versions of the Z100 and Z150 will also be added to the GSA contract. The Z138 will have an initial GSA price of $1,399, not much lower than the Seequa machine, but lower by enough, they hope, to make a difference when purchasing decisions are being made during the Seequa contract's first year.

Gallagher also added grist for the rumor mill. He mentioned unconfirmed reports that Zenith would be coming out soon with a seven-pound lap-top computer, smaller than even the Z171, and then gleefully didn't deny them. The machine will be made by Matsui and sold in the United States by ZDS, according to Gallagher's reports of the rumors. And, to prove that even Zenith makes mistakes (but we all knew that), he reported that Zenith engineers had told him quite some time ago that a board to make the Z100 IBM-compatible couldn't be made. He indicated that these same engineers are now re-studying the problem. (And, he added with a chuckle, perhaps re-studying the job market.)

Thursday afternoon, Andrew Czernek took the floor to brief attendees on the various terminal-emulation programs available either on the Zenith contracts or from individual vendors. Czernek pretty much just ran off a laundry list of emulators on the market, focusing on those which emulated DEC VT-100 and IBM terminals. Czernek's seminar was less lively than Gallagher's, since he just offered a product listing, no gossip.

One other seminar of particular interest was simply titled "User Groups," in which Lieutenant Commander Mike Todd told how valuable a user group could be for support to military micro users. *Sextant*'s technical editor, John Walker, reminded all Heath/Zenith users in attendance that Heath Users' Groups are already in place all over the country, and suggested stopping by the Sextant booth to pick up a copy of *The 1984 Buss Directory*, with its listing of local HUGs. We met quite a few very nice people after that, who were glad to have such a source of information.

Getting around

John and I had the opportunity to see for ourselves how helpful a users' group can be when we accepted *Sextant* contributor Alison Phillips' invitation to visit

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the Tidewater HUG (THUG) meeting the Tuesday night we were in Virginia Beach. It was my first HUG meeting, and I was surprised at all the activity. The group met at the local Heath/Zenith Computers and Electronics Center.

We were introduced as visiting celebrities (rather embarrassing), but then the group got down to business. An open question-and-answer session began the evening, with machine-specific questions and problems from individual members being discussed by the group, with answers and solutions suggested. A scheduled presentation followed. Lieutenant Commander William Locke took the better part of an hour to discuss some of the theoretical and practical considerations involved in turning on just one pixel. After that is learned, he asserted, it is a simple matter to begin writing all sorts of graphics programs.

The evening ended after store manager Paul Price held a drawing among the club members in attendance for free software.

Judging Navy Micro by the goal which they set for themselves, it was a success. Plenty of solutions were provided—John and I spoke with several attendees who had gleaned quite a bit from the seminars and exhibits, and were very happy to have come to the conference. There will still be plenty of questions to answer next year, though. As more and more of the military use more and more microcomputers, the questions will just become more sophisticated.

The only change I could request for next year is some time on the beach!

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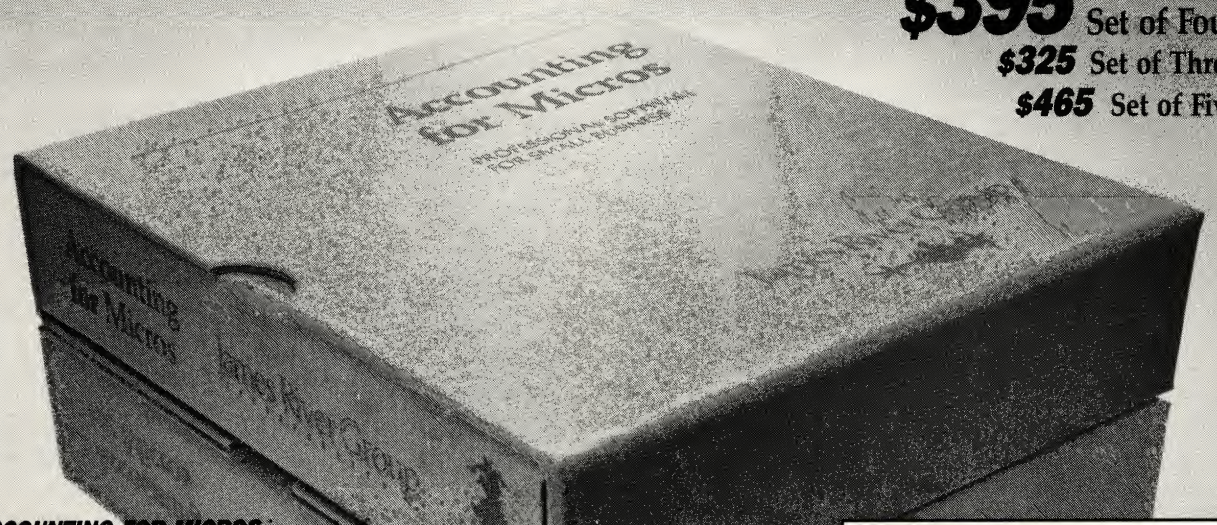

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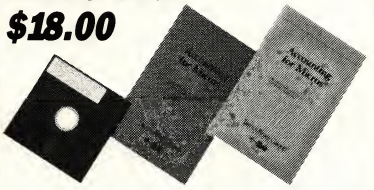

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The Quest for the Ultimate Word Processor

For Z100 users, it's mostly a question of which shortcomings bother you the least.

Kenneth W. Daniel

By the time you read this, it may all be over. Maybe we'll have the ultimate word processor for the Z100 and the need to look further will be no more.

But somehow I doubt it.

The quest seems eternal; just as the latest and greatest program is revealed, the fatal flaw is discovered. I'm speaking personally, of course; we all have our own particular set of "must haves" and "oh no, not again" preferences.

At my office, we started four years ago with our new H89s and Autoscribe, and today I'm writing this article using WatchWord on a Z100. What has happened between then and now provides the basis for this article, along with our dreams about a word processing program which somebody surely will market, soon, and let us settle down at last.

The early days

Does anyone out there remember Autoscribe? It was the first word processing program sold by Heath/Zenith. Autoscribe had its limitations, but there is no use dwelling on those now. At the time, though, those limitations were important.

We couldn't wait to get our hands on Magic Wand. Then we could "type over" text rather than first delete a word and then go into insert mode to replace it; we could finally do superscripts and subscripts.

It has taken me some time to realize that Autoscribe had some features that I didn't fully appreciate, and which I continue to look for with each new system that comes on the scene. For one thing, Autoscribe had a directory "shell" that let you keep track of your document with a descriptor up to 40 characters long. Each document was assigned a number by the system.

In many ways, Autoscribe reminded me of our office's Wang dedicated word processing system. Text was scrolled on a page-at-a-time basis. I don't particularly like that, but it did tell you which page, line, and column you were on.

Flexible document naming and knowing which page you were on were two features sorely missed over the next few years. We used Magic Wand then (now available as PeachText), always wondering whether the thing was going to split a table up over two pages or some such thing.

As to the document indexing, I'm surprised that we haven't seen more in the way of directory enhancements within the popular word processing programs; surely it's not just me who has problems finding a unique name for a file within the limitation of eight characters and a suffix.

Surely it's not just me who has problems finding a unique name for a file.

For the first dozen or so documents that you write, it may be sufficient to use names like ACMECO3.DOC, or FORDTEST-.LTR. With any sort of volume, though, this sort of procedure just gives out. It leaves you scratching your head trying to think of a new name, or trying to remember whether the document you are looking for was called FIELDTST.DOC or JUNETEST.124 or whatever.

Using the system that I've finally come around to in order to put some order into this process, this article is being written as document (file name) 116A, with no suffix for personal word processing documents. That is hardly a universal convention. PeachText, for instance, automatically assigns a DOC suffix. However, I see no need to manually type in .DOC (or anything else) for my text files so long as I remember the convention of whatever word processor I happen to be using.

The documents that I do for work are in the 200 series (216A.DOC, for instance), and the numbers are manually assigned in sequence. Of course, I have to keep a list on the side describing the contents of each. I was having to do that, anyway. And at least now I don't have to stop and think what to name the next one.

Maybe someday we'll have a word processing program that will do all this for us, the way Autoscribe did. I look forward to it.

Some programs I won't get into here

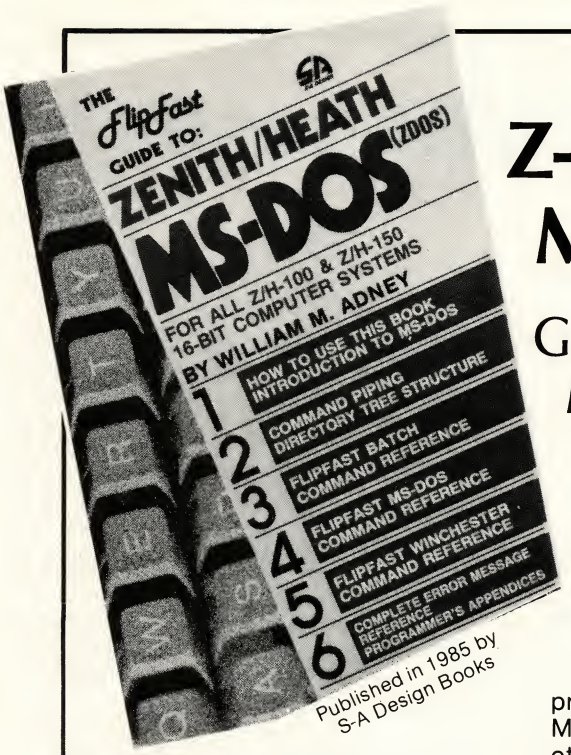
One very popular word processing system for the H/Z89 computers, PIE (from The Software Toolworks), won't receive much comment here. We bypassed it in moving from Autoscribe to Magic Wand, and Hugh Kenner wrote an excellent article on it in the very first issue of *Sextant*. (See "A Professional Writer Looks at Budget Word Processing," Spring 1982.)

Neither can I offer a report on CompuView's VEDIT. (I'm told, though, that it's more of a program editor than a text processor.) And I'm sure that there are others whose omission from this article will generate letters. (It would be wonderful if one of those letters pointed out that the program I want is available.)

EDIT19 is a powerful editor for use under the Heath Disk Operating System (HDOS). But for the Z100 it has grown into WatchWord; more about that, later.

We have spent some time at the office with IMAGE, a really nifty graphics/word processing program from MicroArt of Portland, Oregon. IMAGE is great for developing graphics of the block-diagram sort and printing them on (only) a Diablo letter-quality printer. Unfortunately, MicroArt has changed focus and IMAGE is no longer sold for Heath/Zenith computers.

For text, IMAGE had some nice features that other developers might consider emulating. They included multiple assignments for the special-function keys—controlled in a rotating fashion by one of the function keys. IMAGE had its limitations as a text processor, however. This was particularly true regarding the size of the document buffer in random-access memory (RAM). IMAGE was also limited



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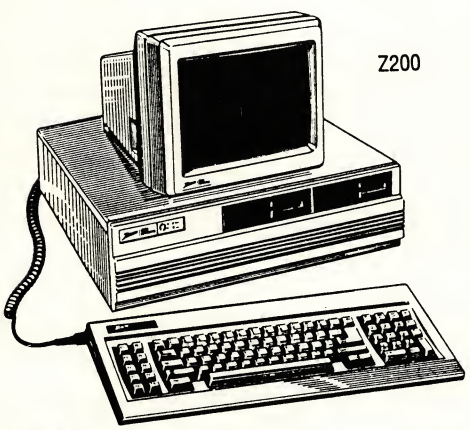

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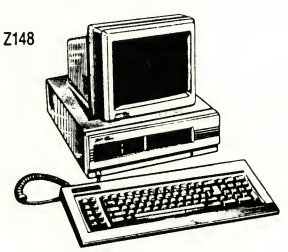

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in the ease with which you could access the operating system and its utilities.

PeachText—nice, but . . .

Both PIE and IMAGE do offer one thing lacking in Magic Wand (which I will usually refer to as PeachText, hereafter). They can scroll rapidly back toward the beginning of the text. PeachText has the annoying feature of writing the entire screen with every single line scrolled backward. Why so, I do not know; none of the other word processing programs that I have seen on the Heath/Zenith machines do this.

Otherwise, PeachText is a fine program with a powerful form-letter capability, something that we haven't particularly needed. Probably its strongest feature has been its ease of use, both in learning and in everyday operation. For instance, the version that comes with the PeachText 5000 package is integrated with the Random House Thesaurus in a very pleasing fashion: just press the F10 key and you have a group of synonyms presented for your consideration at the bottom of the screen. A couple of space-bar strokes and a carriage return and you have your alternate word in the text.

But the frustrations with the program are still there, and I will enumerate my particular list:

a. It has a slow backward scroll.

b. No page breaks or page numbers are displayed during editing.

c. You do not "see what you print"; you see printer codes like \CENTER\ for centering a line and <2> for superscripting a 2.

d. It's a bit slow. You have to go to the main menu, for instance, to call up and load the separate print program. And moving blocks of text requires you to switch into command mode.

On the strong side, PeachText is basically very friendly, and no problem to teach to novices. One feature of note is a very good "include" capability for browsing through a second document, searching for a section to be included in the primary document.

And finally, it has one feature which I am coming to realize is more of a bonus than I knew: automatic reformatting. When you add or delete text, PeachText automatically rearranges the paragraph to fit within the appropriate margins. More about that feature when we discuss WordStar and WatchWord, which don't have it. PeachText has been the word processor to which most of the people in our office have always returned when giving up on the latest whatever.

We do a lot of technical report writing at our office. PeachText has usually proven adequate, but it's often frustrating for this type of writing. With technical reports, the positions of page breaks are important. It is important that a table be printed on a single page in its entirety. Breaking a page is under your control with PeachText, but you have to force it by putting in new page-print commands. That is a simple thing if the table is to occupy a single page by itself, but not so simple if you are trying to include the table in the midst of a certain section of text.

You can "print the document to screen" and see where the printed page breaks occur. This, however, can turn into an iterative chasing-your-tail exercise—which would not be needed if these breaks were displayed during the edit phase.

PeachText doesn't seem to be alone in this. In *Byte* magazine, Jerry Pournelle has lauded WRITE by Workman Associates. From what I understand of it, it handles page breaks in the same way as PeachText, and Jerry thinks that WRITE is really the best thing around.

Using WatchWord is a little like driving a sports car.

I suspect that the difference between his biases and my own is the difference between the demands of prose composition and technical report writing.

For technical writing, there is also the problem of printing formulas, or worse: Greek and math symbols. The common way to do this is to do all the super- and subscripting using the word processing program, then type in the Greek and math symbols by hand for the final copy. For intermediate drafts, hand lettering is faster, but still a real bother.

Once you get to anything other than the most simple formulas, the print-control symbols in PeachText can make it a real mess to align numerators and denominators on top of each other; this is especially true with the spaces left for special symbols, not to mention the double-height symbols and the problem of underlining without bumping into super/subscripts and integral signs. It is still better than hand typing, but PeachText is very cumbersome for such applications. This is what drove us to WordStar.

Then there was WordStar

WordStar is, of course, the most popular word processing program ever. Its most notorious feature is its insistence that you use control-keys for many commands rather than making use of the special function keys. (For instance, CTRL-E, rather than the up arrow, moves the cursor up one line.)

However, several patches are available to install the function keys on the '89 and the '100. And with version 3.3, the keys are already installed for the Heath/Zenith machines.

WordStar was an improvement in several of the areas mentioned above. Among its noticeable strengths are:

a. on-screen centering, sub-paragraph indenting, etc.;

b. ability to hide the super/subscript print-control characters, as well as those for underlining;

c. fast backward scroll;

d. display of page, line, and column numbers;

e. dynamic page breaks displayed during editing;

f. highlighting of blocks of text for moving, deleting, etc.;

g. column copy/move and decimal tab to align columns of numbers on the decimal point.

With these improvements over PeachText, you lose a few things as well.

In our case, the most significant loss was that we had to go back to reformatting paragraphs manually. Compared with PeachText, this is an important loss when it comes to making any significant editing changes to conventional text paragraphs. What WordStar brought in its favor, it took back in frustration on this one point—for me at least.

Two other aesthetic shortcomings of the program are immediately apparent: the screen's response to the keys is not as crisp as with PeachText, due to some kind of buffering. Also, menus rely extensively on disk overlays; it's time consuming and distracting when they're loaded. They can be suppressed, though.

These two distractions can be minimized in the following manner: set the help level to level 1 by Control-JH1 to remove the help-menu overlays; and turn off the on-screen right justification and hyphen-help with Control-OH and Control-OJ at the start of your editing session.

These steps will improve the key/screen response crispness somewhat. Before the final print session, reformat all the paragraphs, with right justification if desired.

It seems to me that WordStar requires an undue amount of attention be paid to paragraph patching-up and formatting as compared to PeachText. It really shines, though, on page control and table structuring and moving about.

The method for including a portion of a secondary document into the primary one with WordStar is to read the entire secondary document into the primary one, subsequently discarding the unwanted portions. When you have two large documents and limited memory, the problem is obvious.

Another characteristic of WordStar is that its documents are not "conventional" text files: so-called "soft" carriage returns are embedded in the text at the end of each line. Control

characters and ESCape sequences are also embedded in the file for printer control.

Also, WordStar sets the high-order (eighth) bit of the last character of each word. This may be the reason why a WordStar file is not as easily used with another word processing system as is a PeachText file.

WordStar does permit you to create a "non-document" file in which no high bits are set. However, to keep the file all ordinary ASCII, you wouldn't want to include any printer-control commands.

The PeachText file does not have printer commands embedded as control characters into its primary text file. Instead, it includes the keyboard command symbols used by the print program. These are in the form of ordinary ASCII characters: \CTR for centering, for instance.

In approaching WordStar, the complexity of the program is a real barrier to many people. I gave up and went back to Magic Wand/PeachText twice before finally trying a third time. It takes the concentrated effort of a full day or two to get used to the WordStar command structure.

The learning process is helped considerably if one of the special function key patches is employed. We have looked at two: ZSTAR by Patrick McNally and WSKEY by Skill Data, both advertised in *Sextant*.

WordStar version 3.3 installs the function keys so that they are similar to ZSTAR. With both of these, the scroll keys are not on the special-function row. Instead, that row has the "operation-prefix" keys, such as CTRL-K to select a block of text to be moved. I prefer the WSKEY method, in which the keys are installed so that scrolling on the '89 is similar to PeachText (or similar to PIE, if you prefer).

Version 3.3 allows the user to specify the default system configuration, such as help level, justification on/off, margins, and hyphen-help as mentioned earlier.

I finally came to prefer WordStar to PeachText. Unfortunately, I have been unable to convince my fellow workers to make the necessary effort to learn it. They have seemed more able to cope with the frustrations of PeachText than I have.

We have had a consensus on one thing, however: a program which would handle Greek and scientific symbols on the screen would probably be worth learning.

And that brings us to WatchWord.

WatchWord

I am the only person in the office who has taken the trouble to learn WatchWord. It's from S & K Technology, of San Antonio. We bought five copies of it for $250, a real bargain for everything that it does. I won't go into a detailed review, since WatchWord has already been reviewed in detail in *Sextant*. (See "WatchWord: Custom Built for You and Your Z100," by Beaufort Lancaster, *Sextant* #14, January-February 1985.) I would, however, like to put my experience with it into the perspective of these earlier programs and others that appear to be on the horizon for our Heath/Zenith community.

There are three principal points that I would like to make about WatchWord: (a) it is powerful; (b) the manual is brief; (c) early versions of the program were not bullet-proof (although the latest version appears to have fixed things). It is probably for a combination of these three facts that my compatriots have not adopted it as their own.

I do recommend that the Heath/Zenith community support this program. Buy it. It's inexpensive, and further fine-tuning of the program is likely if S & K continues the level of support they have shown thus far. As mentioned earlier, this article was written using WatchWord.

Let me describe the feeling that one has when sitting at the keyboard of a Z100 using WatchWord—as compared with PeachText and WordStar.

The first thing that I notice is that the

keyboard is quiet; there is a QUIET command within WatchWord. This turns off the audio pip of the normal keyboard operation and can be installed in an auto-configuration file.

The next thing that you might notice with WatchWord is a rather nice command-and-status portion of the screen. The 25th line of my present screen informs me that it is 9:09 p.m.; I find this current-time feature very helpful. It's right there in the lower right of the screen; unobtrusive, but available.

Also on the 25th line is the name of the document, the current line and total lines, the column, and the amount of memory being used and still available. The fact that I'm in autowrap mode, insert-character mode, and autosave mode is also indicated.

With autosave mode, after a certain number of changes to the text, the file is re-saved and your input halted for a couple of seconds. It's a nice feature, and you can set the number of changes that will trigger the save.

Like PeachText, and unlike WordStar, WatchWord has you toggle between a text mode and a command mode. In the case of WatchWord though, you do not lose sight of your text on the screen when entering the command mode. Rather, the cursor simply jumps to the command line—which is fenced off by separator lines from 21 lines of text above and the status line below.

Color video is supported and can be assigned to the various portions of the display as desired. I find it appealing, even with only an amber monitor, to assign the command and status lines and separators a different color (intensity) from the text.

The screen may be split between two documents or two parts of a single one, and you can do cutting and pasting between the two screens.

All that is the visual effect presented by WatchWord.

Speed and flexibility

Compared with WatchWord, the other word processors seem slow and sluggish.

Printing is more convenient, too. You can print your text without having to save the document beforehand (as with WordStar). Nor do you have to invoke a separate print program (as with PeachText).

Simply jump to the point from which printing is to commence, and enter PRINT n from the command line. (Here, n is the number of lines to print. Or use * to print to the end of the file.)

Immediately your printing starts; no intermediate menus or questions to answer, no set-up screens. If you have a print-spooler program installed, you can be back doing more editing in a few seconds, while your printer does its job; you've never let the text on your screen out of your sight.

Things happen fast with WatchWord, especially scrolling and printing. WatchWord was written exclusively for the '100 (in 8088 assembler) and makes exhaustive use of the function keys (in both normal and shifted mode) as well as the keypad (for things like moving the cursor a word left or right, or marking a place for easily returning to it).

Finally, WatchWord is capable of displaying Greek and math symbols on the screen, as well as super/subscripts and underlining. It was this latter feature that persuaded us to buy the program. It looked like here at last was *the* program.

Unfortunately, the promise has not held firm, but I have not given up yet.

When it comes to writing prose I want to concentrate on my words themselves, not on their "high-order bits."

WatchWord does have its own set of limitations, idiosyncrasies, and problems. Some of these have been taken care of with the release of version 2.0, but significant shortcomings remain.

The ability to display Greek and math symbols is surely there; but only with version 2 is it simple to do; the version 1 manual didn't tell you how to do it.

The demonstration disk proved that it could be done. But you had to take apart the demonstration file to learn the association between special control functions and their corresponding display symbols. The symbol was displayed only when you commanded a special enhanced display mode, which was double-spaced to allow room for underlining and double-height characters like integral signs.

With version 2 this problem has gone away. In addition, enhanced mode is now single-spaced, with the double-spaced enhanced mode called Super Enhance.

As far as getting your printer to print these same symbols, you're on your own—unless you have a C. Itoh Prowriter, for which the Greek font is supported by WatchWord 2.0.

The manual does give some help for handling other printers, though. Part of the flexibility of WatchWord is its ability to assign any output printer code to any string within the text. Thus if your printer would like to receive an ESCape-C sequence to start underlining (as does the Okidata 92), then that sequence can be linked to an arbitrary keyboard input, say CTRL-W, which in turn can be linked to the screen underline function.

I have been successful in getting my Okidata 92 to do superscripts, subscripts, and underlining in coordination with the enhanced WatchWord display mode. That took me about a day with the WatchWord and Okidata manuals and a good bit of trial and error. This whole process has been taken care of in version 2 with an extensive installation/customization program.

I have not had the energy to do the further customization to make my Oki print math and Greek; that is a good problem for some system house within the Heath/Zenith community. As a matter of fact, Wheatstone Systems in Kansas tells me that they are in the process of developing some custom downloadable fonts for the Oki printers; maybe they will be the people to make WatchWord write math symbols and Greek on an Oki or other graphics-capable printer. They haven't done so yet. But they do have a utility (called PrinTerrific) which allows you to create your own custom font.

From these preceding comments, it should be clear that one of the most interesting aspects of WatchWord is its customization potential, and this has been facilitated by version 2's installation program.

Without going into very great detail here, it's possible to customize the special-function keys, create macros, and develop new commands.

The macro capability is particularly convenient. You can create macros in the normal fashion, setting up a disk file containing a series of WatchWord commands to be acted upon whenever you direct. Or you can set up a function key to do a job. Simply hit the ESCape key and then the function key; then go perform whatever series of actions you wish. Switch between modes, use functions keys, do whatever you wish; then hit the function key again. Whatever you did is stored away to be re-enacted whenever you hit the function key again. (Of the other word processors I've mentioned so far, only PIE and EDIT19 have a disk-macro capability. WordStar, though, allows key macros.)

WatchWord is a program that is just begging for our user community to come to its aid and help it reach its full potential. (For my tastes, the special-function keys definitely could use some reassignment.)

I propose to divide up the deficiencies of WatchWord into three categories: (a) things that need to be "customized" using the inherent capabilities for such customization; (b) apparent bugs in the program which will presumably be taken care of in future versions; and (c) weaknesses due to the

basic structure and design of the program. Following are some examples of each.

Customization needs

1. Many users will need to link the enhanced mode (math/Greek) display symbols to downloadable custom fonts for printers such as the Okidata 92, the MPI-99G, or to selectable-font cartridges on the TI 855.

Two other customization needs have been so simplified in version 2 that they can no longer be called deficiencies, but are noted here simply as things that need to be done during installation.

2. You should create macros for your printers for special print features (underlining, superscripts, subscripts, correspondence quality mode, etc.).

3. Many users will want to reassign special function keys to some of the more popular commands such as Paragraph Format, Center, and Split/Switch Screen.

Bugs?

1. You can lose autowrap mode inadvertently while making corrections during text input.

2. Funny things can get printed occasionally.

Some amplification here is in order. First, bug (1) is a case of "That's not a bug, it's a feature!"

What happens is this: suppose you are entering text and decide to back up a few words and do a few deletes and insertions. You then go back out to the end of the line and continue your text entry. All of a sudden, you notice that you are on column 120 or so, and all the rest of your document is slipping off of the left side of the monitor.

You have lost autowrap, and are benefitting from WatchWord's horizontal-scroll feature.

What really happened is that when you inserted those extra words, you pushed the end of the line out past whatever right margin you had established. WatchWord assumes that you know what you're doing when you put in words outside the margin. Autowrap is only in effect *inside* the right margin.

To get around this, I install a special function key macro before every edit session to recover from losing my autowrap in order to avoid constantly having to do about six keystrokes to get back to where I was. Here's the macro:

1. Shift-Keypad 1 (Ensure that we are in COMMAND mode.)
2. Keypad "." (Mark place in text.)
3. FORMAT (Format to end of paragraph.)
4. Shift-Keypad 2 (Go back into SCREEN mode.)
5. Keypad "-" (Return cursor to where we were.)

It's a little easier with version 2, since I have installed the FORMAT command as a special function key which is functional in screen mode, so I don't need to do all of these steps. But it's still annoying.

As to bug (2), here's an example. Headers are placed in a WatchWord file as they are in WordStar, with dot commands. I removed one such dot-command line since I no longer wanted a previously used header; WatchWord, though, insisted on continuing to print the header.

I got it to stop by putting in a new dot command with a blank header. After I removed the new blank header line, it behaved properly, as it should have after I removed the original header line. I have not had this happen with version 2 (yet), but I did have one rather bizarre occurrence while editing this very document.

I had had all my text indented so that it would print in the center of the page. With version 2, however, I could take advantage of its much appreciated PINDENT n command. This achieves the same end by offsetting the leftmost print margin to column n. So, I was using my newly installed FORMAT function key, moving every paragraph over to the left margin, column 1.

After a few successful FORMATs, all of a sudden I found myself at the top of the document with a bunch of hard carriage returns. (And the printer-control "dot" commands at the top of the file were stripped off.) This happened twice. A third try at using my FORMAT key was successful.

I hesitate to report something that I haven't been able to replicate consistently, but it did contribute to my general nervousness in using WatchWord. The problem may have arisen because WatchWord expects FORMATs to be done only in command mode, and I used the key in edit mode. Whatever the reason, it does indicate the need for care in using all of WatchWord's flexibility.

Design deficiencies

These are a matter of personal taste, of course, so to call them deficiencies is perhaps presumptuous on my part. But these are the things that have kept me looking forward to whatever is coming next.

1. Paragraphs have to be reformatted manually.

2. There is no dynamic page break display or on-screen page number.

The requirement for manual paragraph reformatting is what made me miss PeachText during my WordStar days, and it was indeed a great disappointment to find that WatchWord required it. On top of the requirement itself, WatchWord doesn't do it manually as nicely as does WordStar.

In fact, version 1 had a bug in this department. You would normally just type in text and separate your paragraphs by a carriage return and another carriage return (for a blank line). The problem came up if you then attempted to reformat the entire file using FORMAT * (where the * means all the lines in the file). The formatting would hang up at the end of a paragraph and give you an error message that there was a "word longer than line." (If you're still laboring with this, it's time to contact S & K for an update.)

With WordStar, you could put it in a "repeat next command" loop and have it repeat its formatting from top to bottom, but I haven't been able to do that with WatchWord. The author of WatchWord, Steve Robbins, tells me that he has looked at automatic reformatting and found it to run too slowly for his taste. But he hopes to come up with a new idea on how to do it. He's also considered putting in the page-break displays. So stay alert for future releases.

The WatchWord manual says something about designating the end of each paragraph with a special marker having its high-order bit reversed. And in fact there is a special-function key installed for switching the high-order bit of a character. Perhaps that would have been the secret, but the manual is a bit cryptic for me at that point. And getting the update was much easier.

One thing does seem clear to me: even though I'm an electrical engineer and much given to gadgetry, when it comes to writing prose I want to concentrate on my words themselves, not on their "high-order bits."

In fact, with version 2, I have removed the Change High Bit function key, and made it a control function command. There is one very useful related WatchWord command: CLEAR HIGH BIT * will make a WordStar document into a normal ASCII text document.

Enough has already been said about dynamic page breaks, so I'll close the discussion of WatchWord by summarizing. It's powerful, it's fun to use, but it can be a bit annoying.

I wouldn't dare give it to someone who wasn't technically inclined, with just a copy of the manual, and say "Learn this, it's great." With a lot of customization and a healthy enhancement of the manual, I might. At least version 2's manual has a decent index.

Using WatchWord is a little like driving a sports car with a lot of racy features—but without certain creature comforts that you would really like to have.

The future—Word?

So where from here? Is it back to the tried and true, predictable, but somewhat unwieldy WordStar? Or perhaps to PeachText for straight prose documents in order to avoid ever

thinking about reformatting a paragraph?

The Final Word has been available for even the '89s. Moreover, it has a special appeal to those who need a powerful footnoting capability. A friend of mine who is a law professor and given to footnotes which run on for pages bought it for his Compaq for that reason. But he found it incredibly hard to install and went back to something called Bank Street Writer. I doubt that we'll see *that* for the Z100.

However, new things are afoot. Word has been adapted for the Z100, and it will support special print features for most popular printers.

The popular magazines have had a number of reviews of Word for the IBM Personal Computer, and it looks as if it offers relief from at least some of our frustrations. My early experiences with version 1.10 for the Z100 confirm this hope. (And version 2 is now available for the Z150.)

Paragraphs are automatically reformatted, and special print features are displayed directly on the screen, including underline, superscripts, italics, and boldface.

The Z150 version supports on-screen display of the extended IBM character set, which includes some Greek and mathematical symbols. You hold down the ALT key and use the keypad to enter the ASCII number of the special symbol. Unfortunately, Word on the Z100 doesn't support the ALT-keypad entry, nor does it allow toggling to a different ALTCHAR set as WatchWord does.

Word does display page numbers, but you have to make any change in pagination manually or wait for printing. This has been criticized by a number of reviewers as cumbersome, but the feature is deliberate. This way, your page breaks always represent their position as of the last printout, thus corresponding to your last hardcopy draft. What you don't have is *dynamic* page breaks, as with WordStar.

In approaching WordStar, the complexity of the program is a real barrier to many people.

It is also significant, though, that WordStar loses track of what page you are on if you change line spacing (with dot commands) in the middle of a document. Microsoft Word is very sophisticated in keeping track of line and character spacing. It is designed to be able to serve as a typesetting word processor supporting a laser printer. Apparently, this extra sophistication is what drives Word to manual repagination.

Perhaps as a result of this printer-support complexity, reviewers have found Word slow in a number of operations. Using an earlier version of Word while reviewing the Z150 for *Sextant*, Frederick Zimmerman actually switched back to WatchWord on the Z100 after starting to edit the document on a Z150 using Word. In text editing, he found Word deficient by comparison. (See "Zenith Improves on the IBM PC," *Sextant* #11, July-August 1984, and "Microsoft Word and Mouse: Do They Click?" by David R. Felstul, *Sextant* #14, January-February 1985.)

As far as Word's mouse capability is concerned, it sounded like the sort of thing that would let us scroll through a document rapidly. With some packages, you can zip your mouse along the desk and watch the lines fly by. Unfortunately, Word's mouse gets more cumbersome if you wish to move above or below the current screen.

In any event, the mouse is not supported for the Z100 version, but I'm happy with a logical command structure and a good function-key arrangement. Thus far I'm happy with both those facets of Word.

One feature that version 2 provides is the ability to dispense with the two lines

used for command display at the bottom of the screen. Here's hoping we get version 2 for the Z100; version 1's screen is a bit "busy" with the commands constantly displayed. If you are familiar with the Multiplan display, Word looks the same.

Also, the text area is surrounded by a border which I would just as soon do without. It makes me feel as though I'm looking through a window pane. However, the top line of the border can be toggled to a ruler, a useful feature.

Word has an un-do command, automatic footnote placement, and double-column printing. Unlike WordStar, though, it does not have table column operations.

One more thing: in the case of my Okidata 92 printer, Word supports only a pitch of 10 characters to the inch for correspondence-quality print. You select the printer pitch and mode from within Word by choosing "fonts" from a set allowed for each supported printer. Although the Oki is perfectly capable of printing correspondence quality at 12 pitch, Microsoft did not choose to support that capability. You cannot set your print modes externally by the switches on the Oki, either; the printer-support file sends the printer a reset prior to each print job.

The only way around this problem is to tell Word that you are using a plain teletypewriter instead of the Oki; then you can set the pitch and mode externally. But then you get a broken underline instead of a solid underline. You just can't win, it seems.

However, this can all be fixed by patching the printer-definition file, which I intend to do. By and large, I'm pretty happy with the way Word has been adapted for the Z100, and I look forward to version 2.

WordPerfect? Palantir? Samna Plus?

Those little problems bring up one very major point that I would like to make as we consider the latest generation of word processors for the Z100: *When Zenith doesn't do the adaptation, be careful of Z100 adaptations of programs done originally for the IBM Personal Computer.* Drive it before you buy it.

As of this writing, WordPerfect 4.0 for the Z100 had been on the market for a few months, and MultiMate has just been released. Less well known than these, the Palantir Word Processor, written by the author of the original Magic Wand, has also been released for the Z100. In each case, the Z100 implementation has problems. Here's hoping they will be corrected. Let me describe what I've seen.

WordPerfect, from Satellite Software International (SSI), is currently one of the most highly regarded programs around; it's a truly full-featured word processor. It has automatic footnoting and automatic reformatting. It supports multiple columns and indexing. It doesn't have split-screen operation as such to show you two files or parts of the same file; but it accomplishes the same end with a dual-screen feature that lets you toggle quickly between the two screens. To top it off, it has a very nice command structure.

However, the Z100 version has not incorporated what SSI calls its "flash" speedup—which is included in the IBM-PC version. The difference between the two versions is enormous. With the Z150 running version 4.0 for the IBM PC, the screen can be rewritten in about half a second. With the Z100, it takes about five seconds.

What's worse, the particular type of automatic reformatting used by WordPerfect comes into its worst with the slower-running version. As the cursor is moved down past existing lines of text, all lines are reformatted automatically—whether they need it or not. With the Z100 version, each downward movement results in an annoying screen flicker as each line is reformatted. This is too fast to see on the Z150.

All this is a shame, since the Z100 function-key arrangement for WordPerfect is far superior to that for the Z150. One of the few complaints about the Z150 version is the necessity of using each function key four ways (regular, shifted, CTRL and ALT). With the Z100, WordPerfect takes advantage of the additional keys available; only normal and shifted are necessary.

The Palantir case is even worse. Every time you jump from page to page in the Z100 (generic MS-DOS) Palantir, the scrolling jerks a line at a time. I simply can't watch it. It's a shame because the program seems nice otherwise.

What is happening may be this: the Z100 version is actually a patched-up IBM version. It is run under some sort of emulation routine which is trapping out the infamous special terminal-graphics calls that make the IBM PC unique. In order to deal with the extra work so generated, these programs must run slower (and less smoothly) than they would on an IBM compatible.

Samna Plus is one package which has not been specifically adapted for the Z100 yet—because they are unwilling to make such a compromise. They tell me that they may release a true Z100 version because of the government market, but haven't yet decided.

Samna Plus is a really full featured system for the Z150, including an integrated spreadsheet, plus line and box drawing. The word processor alone is known as Samna Word III. (Maybe someone could talk the Navy into footing the bill for the conversion?)

MultiMate, Leading Edge, or Wang?

MultiMate and the Leading Edge are designed to emulate the Wang word processing structure as closely as possible. The Wang operation is a rather good one; its principal drawback from my perspective is its page-scrolling. (You can't back up just a line or two into the previous page.) But that's not serious.

I've barely had a chance to look at the new Z100 release of MultiMate, but its default installation results in a real oddity: a double key click every time you press a key. It's really disconcerting. I can't believe that this won't get fixed straight away. (Apparently the reason we have a Z100 version of MultiMate is because of the Air Force and the Navy; I'm sure that they won't settle for such a thing.)

MultiMate does offer a document-indexing shell, with keyword identification of each document. The name you give a document is mapped to an MS-DOS file name. It will warn you if the name is already in use, but it won't create a non-conflicting name.

By contrast, the Leading Edge word processor, which is not available for the Z100, has the best document filing shell I've seen. You give a document a name up to 30 characters long, and Leading Edge produces an non-conflicting file name from these. Your index is displayed as the 30-character description. It employs a hierarchical directory scheme, asking you to assign "file drawer" and "folder" names to its levels of organization.

Leading Edge keeps the Wang display format, but does allow you to scroll over page boundaries. It's a real shame that this program isn't available for the Z100; it only costs $100, and can be gotten for $85 discounted. It does lack some of the power of MultiMate; for instance, the ability to cut and paste columnar data. Neither of these products has footnoting like Word or WordPerfect.

One further observation on the Wang type of word processor. I just spent some time with the new Wang Professional Computer, comparing their microcomputer implementation of Wang word processing with their dedicated word processor structure. It's pretty near the same, except that they have abandoned their document-indexing structure in favor of the standard MS-DOS or CP/M file structure designators. I was sorry to see Wang do this, and my previous comments on indexing still hold.

Wang is about to release an IBM-compatible version of their word processor, so Z150 users should take a look at it.

We have one advantage in the Heath/Zenith community in comparison to the IBM world: We don't have the confusion generated by a couple of thousand word processing programs competing for our attention. Hopefully, the people at ZDS and at our Zenith-sympathetic system houses will screen these for us, and adapt only the best ones to Zenith machines.

That will save us from going almost crazy trying to figure out those performance matrices published with every article which tries to address the general problem of word processing. Without attempting to produce one of

those, I will offer a collection of features which I'm still trying to find in a single word processing program.

What I'd ask for

Here is my list of features (and some available programs having each one).

1. Automatic paragraph reformatting — PeachText, Word, WordPerfect (not instantaneous), MultiMate
2. On-screen display of underlining and superscripts—Word, WatchWord
3. Special symbol (i.e., control character) display and printer support—WatchWord (to an extent)
4. Expanded document indexing—Autoscribe, MultiMate
5. Dynamic page break displays—WordStar, WordPerfect, Word (pagination required)
6. Print partial document from edit—WatchWord, WordPerfect, Word
7. Undo command — WatchWord, Word
8. Macro capability—WatchWord, PIE, WordPerfect, MultiMate
9. Cut and paste between documents—WatchWord, PeachText (to an extent), WordPerfect, Word
10. Column move—WordStar, MultiMate, WordPerfect
11. Decimal tab—WordStar, MultiMate, WordPerfect, Word
12. Word count—old version of Magic Wand, Palantir
13. Assignment of color—WatchWord, WordStar, WordPerfect
14. Status line with document number, page, row, column—WordStar, WordPerfect, MultiMate, Word (no row/column)
15. Mix of graphics and text on a page—Z150 Samna Plus for lines/boxes
16. Function key thesaurus—PeachText, WordStar

With Word, the Microsoft people have shown that (1) and (2) are not mutually exclusive. Item (15) is still a bit exotic, but it's available for some of the new integrated packages like Framework. The document shell seems like a nice job for someone to patch into any of the popular existing packages. All the rest are available in one package or the other.

Of course, none of these possible benefits will come without a cost. Besides the monetary cost, most of the newer word processors cost quite a bit of memory. MultiMate and Leading Edge, for instance, both require your Z100 to have at least 256 kilobytes. The full Samna Plus package requires 384K.

Nothing, then, is without some cost somewhere.

As I conclude, for instance, I have to admit that writing this article on WatchWord has been rather pleasant. But then again, I've still got to go back and reformat all those paragraphs.

Ordering Information

The FinalWord (Z100 or Z150), $300.
Mark of the Unicorn, Inc.
222 Third Street
Cambridge, MA 02142
617/576–2760

Leading Edge Word Processing (Z150), $100. Also available with Mail Merge, $150, or with both Mail Merge and Spell Check, $250.
Leading Edge Products, Inc.
225 Turnpike Street
Canton, MA 02021
800/343–6833, 617/828–8150

Magic Wand (CP/M on H/Z89 or Z100), $295.
Available through Heathkit catalogue and at Heath/Zenith Computers and Electronics Centers.

MultiMate Professional Word Processor (Z100 or Z150), $495.
Multimate International Corp.
52 Oakland Avenue North
East Hartford, CT 06108
203/522–2116
Z150 version available through Heathkit catalogue and at Heath/Zenith Computers and Electronics Centers.

The Palantir Word Processor (CP/M or MS-DOS on H/Z89, Z100, or Z150), $250.
Palantir Software
12777 Jones Road, Suite 100
Houston, TX 77070
713/955–8880, 800/368–3797

PeachText 5000 (Z100 or Z150), $395.
Peachtree Software, Inc.
3445 Peachtree Road N.E.
Atlanta, GA 30326
800/554–8900
Available through Heathkit catalogue and at Heath/Zenith Computers and Electronics Centers.

PrinTerrific Plus (Z100), $59.
Wheatstone Systems
227 Wisconsin
Lawrence, KS 66044
913/841–2272

Samna Word III (Z150), $550.
Samna Corp.
Suite C–700
2700 Northeast Expressway
Atlanta, GA 30345
800/241–2065, 404/321–5006

Wang Word Processing (available soon for Z150).
Wang Laboratories, Inc.
One Industrial Avenue
Lowell, MA 01851
617/459–5000

WatchWord Version 2 (Z100), $100. Demonstration disk, $3. EDIT19 Version 3.1, HDOS only, $80 (with reference manual) or $95 (with reference manual, tutorial manual, and tutorial disk).
S&K Technology, Inc.
4610 Spotted Oak Woods
San Antonio, TX 78249
512/492–3384

Word (Z100 or Z150), $375.
Microsoft Corp.
10700 Northrup Way
Bellevue, WA 98004
Available through Heathkit catalogue and at Heath/Zenith Computers and Electronics Centers.

WordPerfect (Z100 or Z150), $495.
Satellite Software International
288 West Center Street
Orem, UT 84057
Information: 801/224–4000
Order Desk: 800/321–4566

WordStar, CP/M on HZ89 or Z100, $395; MS-DOS on Z100 or Z150, $299.
MicroPro International Corp.
33 San Pablo Avenue
San Rafael, CA 94903
Available through Heathkit catalogue and at Heath/Zenith Computers and Electronics Centers.

WRITE (CP/M or CP/M–86), $239.
Workman and Associates
112 Marion Avenue
Pasadena, CA 91106
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Heath CP/M Reads Foreign Disks

You can read Osborne and Morrow disks on your '89.

Dennis Shackleton

Read another type of disk on my computer? Impossible! Well, maybe not. If you understand a few basics about CP/M, it can be done.

I've written a little program that allows me to read three foreign disk formats. Quite appropriately, I've titled it FOREIGN.COM. (See Listing 1 for the source code.) It's for soft-sectored CP/M disks running on an H/Z89 (or on an H8 with a Z80 central processor). And it gives me access to Morrow, Osborne single-density, and Osborne double-density disks.

Reading these disks, of course, does not mean that a program specifically tailored for one of these computers will run under Heath/Zenith CP/M on the H8 or H/Z89. One reason for this is the fact that commands to the terminal are not usually the same. (A good example of this is the version of SuperCalc written for the Osborne. You cannot purchase the program and run it on your '8 or '89. It simply will not work.)

Extreme care, then, should be taken before shelling out $200+ for a program. Programs written in Microsoft BASIC, however, can frequently be transferred with only slight modifications, even when screen commands are used in the program.

You should also note that FOREIGN was written to run under CP/M version 2.2.03. Heath has released a new version of its basic input/output system (BIOS) for CP/M. FOREIGN will run under the later version. But (as we will get into later) you will need version 2.2.03, and the FORMAT routine associated with it, to follow the procedure described in this article.

For me, FOREIGN.COM proved to be more of a learning tool than anything else. It uses CP/M's *disk-parameter header* (DPH), *disk-parameter entry* (DPE) tables, and *disk-parameter block* (DPB).

Information on these subjects can be obtained directly from the Digital Research manuals. I won't say it's easy to extract, though. So a brief review may be in order. (I won't get too involved, here. There are several good articles and books on these subjects. Some are noted at the end of the article.)

Two tables

The DPH and the DPB are two tables in CP/M's BIOS. The DPH is, in effect, the "index" to the DPE tables. Together, the DPB and the DPE tables almost totally explain how information is stored on the disk.

Setting up these tables for the first time is a long, drawn out process. It involves several decisions that have to do with the speed and efficiency of input/output (I/O) between the computer and the disk. We won't have to get involved in that, however, since the manufacturer has already done it. The basic structure of these tables is established when a disk is formatted. All that we have to do is use these tables to access the disk.

What does FOREIGN do?

Before getting too deeply into the mechanics, let me give a brief explanation of FOREIGN.COM. It is designed to use two disks: disk A is a normal Heath/Zenith disk; and disk B is a foreign disk. You can't use any disk C because FOREIGN will use drive C's checksum table as a translate-table storage area. This renders drive C useless. (The checksum table and the translate table are discussed later.)

When a disk is mounted, the Heath BIOS for CP/M reads the disk label, the first sector of the first track. This is to determine the format of the disk (single density or double density). The foreign formats don't have this information there. So, to avoid an error, we must prevent the reading from happening. And we must find some way to give CP/M the disk-format information. That's where FOREIGN.COM comes in; it does both.

When FOREIGN.COM is first loaded, you will give it the format information needed to read the disk. FOREIGN will then go to the BIOS's SELDSK routine and set a flag to indicate that it has been loaded; it will store the needed

16 bits (2 bytes)	translation table
48 bits (6 bytes)	CP/M use
16 bits (2 bytes)	directory buffer
16 bits (2 bytes)	disk-parameter block
16 bits (2 bytes)	check vector
16 bits (2 bytes)	allocation vector

Table 1. The disk-parameter header (DPH) is a series of addresses, in the order given here, indicating the locations of the disk-parameter entry (DPE) tables and blocks which govern the disk parameters. These entries are standard to all versions of CP/M. Heath/Zenith CP/M's DPH also contains the information given in Table 2.

8 bits (1 byte)	disk type
8 bits (1 byte)	select code
8 bits (1 byte)	number of 128-byte records/physical sector
8 bits (1 byte)	number of 128-byte records/allocation block
8 bits (1 byte)	track location
8 bits (1 byte)	step rate
8 bits (1 byte)	real/imaginary-drive flag
8 bits (1 byte)	last disk mounted

Table 2. The DPH in Heath CP/M also contains the information given here. This is in addition to the information in Table 1, which is standard to all implementations of CP/M.

information in memory. Thereafter, whenever a disk is to be read from or written to, that flag shows which foreign format is enabled. The disk-label reading will be prevented and the information which is in memory will be used.

I put the FOREIGN flag in lower memory so that it would be easy to locate. In lower memory, there are eight RESTART blocks (numbered 0-7); these are subroutine calls for which the 8080 central processor knows the addresses. I picked 37 (hexadecimal); it is the last location in the RESTART 6 block; and it is not used in most commercially available software.

The program listing has been enhanced with remarks to explain what is being done for each routine. This is the easiest way to explain what the purpose of each routine is. You should have few problems following the program this way.

The disk-parameter header

Now for the review of the CP/M tables. (Again, I will not be going into great detail here.) Briefly, the standard part of the DPH is a series of *addresses* indicating the locations of the DPE tables and blocks that govern the disk parameters. The DPB—and the Heath extensions to the DPE table—are each a series of *values* of various parameters.

Together, the DPB and the DPE tables almost totally explain how information is stored on the disk.

The DPH first contains information standard to any implementation of CP/M. It is a series of addresses set up as shown in Table 1.

Heath systems *also* have in their DPH the information in Table 2.

The DPH: standard CP/M

The first 16 bytes are the standard CP/M entries, and are defined as follows:

Translate table—If this is 00, then there is a one-to-one relation between logical and physical sectors on the disk. No translation is needed.

If it is not 00, it is the address of the translate table. The table is used to determine the logical-to-physical sector relation. As far as CP/M is concerned, sectors are one after another on the disk. In actuality, however, logical sector two may be the third physical sector on the disk. The translate table is used to keep track of this.

60 = soft-sectored, single-sided, single-density, 48-t.p.i.
61 = soft-sectored, double-sided, single-density, 48-t.p.i.
62 = soft-sectored, single-sided, double-density, 48-t.p.i.
63 = soft-sectored, double-sided, double-density, 48-t.p.i.
64 = soft-sectored, single-sided, extended-double-density, 48-t.p.i.
65 = soft-sectored, double-sided, extended-double-density, 48-t.p.i.

Table 3. For Heath/Zenith CP/M configured for the H37 controller, the value of the disk-type entry in the DPE table will always be in the 60's.

16 bits (2 bytes)	number of sectors/track
8 bits (1 byte)	block shift factor
8 bits (1 byte)	block mask
8 bits (1 byte)	extent mask
16 bits (2 bytes)	disk size
16 bits (2 bytes)	directory size
8 bits (1 byte)	allocation (high byte)
8 bits (1 byte)	allocation (low byte)
16 bits (2 bytes)	check size
16 bits (2 bytes)	offset

Table 4. The disk-parameter block has 15 bytes in it appearing in the order given here.

Listing 1. FOREIGN.ASM, assembled, will allow soft-sectored Heath/Zenith CP/M to read from and write to three foreign soft-sectored disk formats: Morrow, Osborne single-density, and Osborne double-density.

```
;FOREIGN WRITTEN BY DENNIS SHACKLETON
;FOR THE H/Z 89-90 SOFT SECTOR COMPUTER
;TO ALLOW THE HEATH/ZENITH COMPUTER
;TO ACCESS DISKS USED ON OTHER COMPUTERS
;THE PROGRAM ALLOWS THE HEATH/ZENITH
;OWNER TO READ FROM AND WRITE TO
;
;OSBORNE SINGLE DENSITY
;OSBORNE DOUBLE DENSITY
;MORROW MD SERIES

;FORMAT DISKS
;IT IS WRITTEN TO ALLOW OTHER
;TYPES OF DISKS TO BE USED AT
;A FUTURE TIME

;       PROGRAM EQUATES

        ORG     100H    ;STARTING ADDRESS
BDOS    EQU     005H    ;BDOS CALL
PRSTR   EQU     09H     ;PRINT STRING
CONIN   EQU     01      ;CONSOLE CHAR INPUT
CR      EQU     00DH    ;CARRIAGE RETURN
LF      EQU     00AH    ;LINE FEED
ESC     EQU     27      ;ESCAPE
CLR     EQU     69      ;ESC,CLR CLEARS THE SCREEN
VERSION EQU     12      ;RETURNS VERSION NUMBER
REBOOT  EQU     00H     ;WARM BOOT
DD      EQU     064H    ;DOUBLE DENSITY
SD      EQU     062H    ;SINGLE DENSITY

;       PROGRAM TEXT STARTS HERE
START   LXI     SP,STACK;SET UP LOCAL STACK

;CHECK FOR VERSION NUMBER

        MVI     C,VERSION
        CALL    BDOS
        CPI     20H
        JNC     VERSOK  ;IF C SET BAD VERSION

;BAD VERSION PRINT MESSAGE AND EXIT

        LXI     D,MSG3  ;BAD VERS MESSAGE
        MVI     C,PRSTR ;SET UP FOR BDOS
        CALL    BDOS    ;PRINT STRING
        JMP     REBOOT  ;EXIT

;VERSION IS OK FOR THIS PROGRAM
```

→

```
VERSOK  LXI     D,CLEAR ;CLEER THE SCREEN
        MVI     C,PRSTR
        CALL    BDOS
;PRINT SELECTION MENU

        LXI     D,MSG1  ;SELECTION MENU
        MVI     C,PRSTR
        CALL    BDOS    ;PRINT IT

;SET UP LOCATIONS TO BE USED
DPEBFI  LHLD    001     ;FIND DISK B  DISK PARAMETER
        LXI     D,0063H ;ENTRY AND SAVE IT  DE=
        DAD     D       ;OFFSET FROM BIOS BASE
        SHLD    DPEB
DPECFI  LXI     D,0018H ;DISK C  DISK PARM ENTRY
        DAD     D       ;GET AND SAVE
        SHLD    DPEC
XLATEFI LXI     D,12    ;DISK C  CHECK VECTOR WILL
        DAD     D       ;USED FOR XLATE TABLE
        SHLD    XLATE   ;HOLDS ADD POINTINT TO CVSO

;GET ADDRESS OF DISK B DISK PARAMETER BLOCK
DSKBPRM LHLD    DPEB    ;B PARM ENTRY
        LXI     D,10    ;DPB OFFSET
        DAD     D       ;POINTS TO ADDRESS WHERE
        SHLD    DPBB    ;DISK PARM BLOCK IS

HEATH   LHLD    DPEB    ;FIND LOC IN HEATH EXT
        LXI     D,18    ;FOR 128 BYTE RECORDS/SECTOR
        DAD     D       ;AND SAVE IT
        SHLD    RPSEC   ;+1 IS SEC/ALLOC BLOCK
DENSITY LHLD    DPEB    ;GET DENSITY LOCATION AND
        LXI     D,16    ;SAVE IT
        DAD     D
        SHLD    DENSTY

;WE NOW HAVE ALL THE LOCATIONS THAT ARE NEEDED
;DPEB   HOLDS DISK B'S DISK PARAMETER ENTRY
;DPEC   HOLDS SAME FOR C  ** NOT USED **
;XLATE  HOLDS ADDRESS THAT POINTS TO WHERE
;       TRANSLATE TABLE WILL BE LOCATED
;DPBB   HOLDS ADDRESS THAT POINTS TO WHERE
;       DISK PARM BLOCK IS LOCATED
;RPSEC  ADDRESS IN HEATH EXT FOR REC/SEC
;DENSTY HOLDS THE ADDRESS THAT DENSITY IS STORED IN

;GET TYPE OF DRIVE TO EMULATE

GETTYPE MVI     C,CONIN ;BDOS CONSOLE IN FUNCTION
        CALL    BDOS
        CPI     31H     ;CHECK FOR MORROW
        JZ      DISK1   ;GOTO DISK1 IF MORROW
        CPI     32H     ;CHECK FOR OSBORNE SINGLE
        JZ      DISK2   ;AND GOTO DISK2
        CPI     33H     ;CHECK FOR OSBORNE DOUBLE
        JNZ     ERROR   ;NO SUCH DRIVE EXIT

;IF MORE DRIVE TYPES ARE ADDED SAME FORMAT ABOVE
;SHOULD BE USED.  FOR EXAMPLE
;       CPI     33H     ;CHECK FOR 3RD DRIVE TYPE
;       JZ      DISK3   ;GOTO 3RD TYPE
;       CPI     34H     ;4TH TYPE
;       JNZ     ERROR   ;NO SUCH DRIVE EXIT

;THE FOLLOWING ROUTINES ARE BASICALLY ALL THE
;SAME. IF MORE TYPES ARE ADDED THE SAME
;FORMAT SHOULD BE FOLLOWED.

;OSBORNE DOUBLE DENSITY
;** DISKS WITH NO XLATE TABLE FORMAT

DISK3   STA     TYPE    ;SAVE DRIVE TYPE
        LXI     H,0     ;NO XLATE TABLE FOR
        CALL    TRANPT  ;OSB DOUBLE DEN
        LHLD    DPBB    ;HL=B'S DISK PARM BLOCK ADD
        CALL    HIHL    ;GET REAL ADDRESS
        LXI     D,OSDPB ;D=OSBORNE DOUBLE DENSITY
                        ;DISK PARM BLOCK
                        ;HL=ADDRESS TO MOVE IT TO
        MVI     B,15    ;B=NUMBER OF BYTES
        CALL    XFER    ;TRANSFER IT
        LHLD    RPSEC   ;RECORDS/SECTOR LOCATION
        MVI     A,8     ;8 128 BYTE REC/SECTOR
        MOV     M,A     ;STORE IT
        INX     H       ;REC/ALLOC BLOCK
        MOV     M,A
        LHLD    DENSTY
        CALL    HIHL    ;GET REAL ADDRESS
        MVI     A,DD    ;SET DOUBLE DENSITY
        MOV     M,A
        JMP     DRIVE2  ;DONE WITH OSBORNE

;MORROW DISK  ** FORMAT FOR XLATE TABLE DRIVE
```

→

CP/M use—This is simply for CP/M to use.

Directory buffer—This is the address of a 128-byte space in memory containing four 32-byte directory entries. (A 32-byte directory entry contains information necessary to retrieve a file from disk: the name of the file, the blocks it uses, etc. For more, see *REMark* #46, November 1983, "The CP/M Directory Structure," by David G. Pelowitz.)

Disk-parameter block—The address of the DPB. (This will be discussed later.)

Check vector—The address of a table of checksums for each directory entry. CP/M uses a formula to derive a value for each entry. When asked to read from or write to a disk, it uses this to determine if a disk swap has occurred that is unaccounted for.

Allocation vector—The address of a table that keeps track of blocks of space on a disk. It is used to determine whether a block is allocated to a file or whether it is open for use.

The DPE table: Heath's extensions

The next eight bytes are unique to Heath systems. Only three of these bytes are important to FOREIGN.

Disk type—This location holds the code representing the type of disk in the drive. Since FOREIGN is for an H37 controller, all of the disk types will be in the 60's. (See page 16 of the BIOS listings.) The codes for the H37 disk types are given in Table 3.

The other two bytes that are important are the number of bytes per sector and the number of 128-byte records per allocation block.

The disk-parameter block

The DPB has 15 bytes in it; it is set up and defined as shown in Table 4.

Sectors/track—The number of 128-byte CP/M sectors on each track. (One record equals one sector.) Remember, this is in terms of CP/M sectors, not physical sectors.

Block-shift factor, block mask, and extent mask—These are all tied together; together, they determine block size on the disk (1K blocks or 2K blocks, etc.) and enable CP/M to get to individual 128-byte records.

Disk size—Total number of blocks on the disk, minus one. (Remember that on the same size disk, this number will be twice as large for a format divided into 1K blocks as for one with 2K blocks.)

Directory size—Total number of directory entries on the disk. A directory entry takes 32 bytes for each file. So four directory entries take up a CP/M sector.

Allocation—These two bytes make up a 16-bit number in high-byte low-byte order. This indicates how many blocks are reserved for the directory entries. Usually two 1K blocks

or one 2K block gets reserved for directory entries. This allows 64 directory entries to be stored.

Check size—The size of the table of checksums (defined in the DPH).

Offset—The number of reserved tracks on the disk. Usually, two or three are reserved for CP/M's use. The directory starts on the first available track after the reserved tracks.

Getting an extra 40K

Before going any further in the article, I'm going to make you 40 kilobytes richer. Get out the trusty disk with the FORMAT routine on it and boot it up. Then call the FORMAT routine.

When the program asks "Density (S=single D=double)", type an "E" and continue as you would normally. When formatting is finished, reboot the system disk and do a "STAT B:" on the disk that was just formatted.

Yes! It can be: a 200K disk. That's what types 64 and 65 are. *Extended* double density gives you 200K disks. That's 40K more than the 160K with double density. (I discovered this in one of my marathon BIOS reading sessions.)

(Unfortunately, you need CP/M 2.2.03 for this step. You'll be able to read extended double-density disks under Heath's later version, but not FORMAT them that way. You may want to have a friend FORMAT some disks for you.)

It gives me access to Morrow, Osborne single-density, and Osborne double-density disks.

And putting it to work

I'm not sure whether I like reading BIOS listings or not; but I read both Morrow and Osborne listings, too! That's when I got the idea for the program. I found that Osborne single-density disks use 10 sectors per track and 256 bytes per sector. That's the same as Heath single-density disks.

Osborne double density and Morrow (double density) both have five sectors per track and 1,024 (1K) bytes per sector. Heath double density is 256 bytes per sector and 16 sectors per track. Bad news, not the same.

The good news is the extended double density. It is five sectors per track and 1K bytes per sector. When I discovered this, my wife had to pull me down from the ceiling. (I was happy.)

Since Heath had already written the routines to read and write to these formats, I didn't have to. All I had to do was change the DPE table, DPB, and

```
DISK1   STA     TYPE    ;SAVE TYPE OF DISK
        LHLD    XLATE   ;ADD HOLDS ADDRESS WE WANT
        CALL    HIHL    ;GET REAL ADDRESS
                        ;OF XLATE TABLE
        CALL    TRANPT  ;POINT TO XLATE AT BEGINING
                        ;OF DISK PARM ENTRY
                        ;HL=ADDRESS OF XLATE TABLE
        LXI     D,MTAB  ;DE=TABLE TO MOVE
        MVI     B,40    ;40 BYTES
        CALL    XFER    ;MOVE IT

;CHANGE DISK PARM BLOCK

        LHLD    DPBB    ;HL HOLDS ADDRESS OF
                        ;ADDRESS OF DISK PARM BLOCK
        CALL    HIHL    ;GET REAL ADDRESS
        LXI     D,MDPB  ;DE=MORROW DISK PARM BLOCK
        MVI     B,15    ;15 BYTES
        CALL    XFER    ;MOVE IT
        LHLD    RPSEC   ;CHANGE RECORDS/SECTOR
        MVI     A,8     ;AND REC/ALLOC BLOCK
        MOV     M,A
        INX     H
        ADD     A       ;A*2
        MOV     M,A
        LHLD    DENSTY
        CALL    HIHL    ;GET REAL ADDRESS
        MVI     A,DD    ;SET DOUBLE DENSITY
        MOV     M,A
        JMP     DRIVE2  ;DONE WITH MORROW

;THE ABOVE ROUTINE IS FOR ANY XLATE TABLE DRIVE
;JUST CHANGE THE PARM BLOCK LOADED IN D
;AND THE XLATE TABLE LOADED IN D
;REC/SEC AND REC/ALLOC BLOCK

;OSBORNE SINGLE DENSITY    SAMO SAMO

DISK2   STA TYPE
        LHLD    XLATE   ;CHANGE XLATE TABLE
        CALL    HIHL
        CALL    TRANPT
        LXI     D,OTAB  ;CHANGED DIFF XLATE TABLE
        MVI     B,20    ;20 BYTES
        CALL    XFER
        LHLD    DPBB    ;CHANGE DISK PARM
        CALL    HIHL    ;BLOCK
        LXI     D,ODPB
        MVI     B,15
        CALL    XFER
        LHLD    RPSEC   ;CHANGE REC/SEC
        MVI     A,2     ;AND REC/ALLOC BLK
        MOV     M,A
        INX     H
        MVI     A,16
        MOV     M,A
        LHLD    DENSTY
        CALL    HIHL    ;GET REAL ADDRESS
        MVI     A,SD    ;SET SINGLE DENSITY
        MOV     M,A
        JMP     DRIVE2  ;DONE WITH OSB SING DEN

;TRANSFER ROUTINE
;DE=BEGINING ADDRESS OF SOURCE
;HL=BEGINING ADDRESS OF DESTINATION
;B=NUMBER OF BYTES

XFER    LDAX    D       ;A=FIRST BYTE SOURCE
        MOV     M,A     ;STORE IT
        INX     H       ;BUMP DESTINATION
        INX     D       ;BUMP SOURCE
        DCR     B       ;DECREMENT COUNT
        RZ              ;RETURN IF DONE
        JMP     XFER    ;LOOP IF NOT

;TRANSFER HL TO ADD POINTED TO BY DPEB

TRANPT  XCHG            ;DE=INFO TO STORE
        LHLD    DPEB    ;HL=DESTINATION
        MOV     M,E
        INX     H
        MOV     M,D     ;SAVED DE
        XCHG            ;RETURN HL ORIGINAL
        RET

;ERROR IS ENTERED IF ILLEGAL DRIVE TYPE IS ENTERED

ERROR   LXI     D,NODRIVE
        MVI     C,PRSTR ;PRINT MESSAGE
        CALL    BDOS
        JMP     GETTYPE

;2DRIVES MAXIMUM NOW  FOLLOWING COMMON TO ALL TYPES
```

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some of the Heath extensions to the DPE table.

Well, almost! I found I had to make two small changes to the copy of the BIOS on the disk I was going to use for my FOREIGN.COM program.

Changing the BIOS

I'll go over the BIOS changes first. You'll need to get the disk that holds 200K and SYSGEN it just like any other CP/M disk. Put the following files on it: BIOS.SYS, ASM.COM, ED.COM, SUBMIT.COM, XSUB.COM, BIOS.ASM, MAKEBIOS.COM, MAKEBIOS.SUB, and PREL.COM.

These are all needed for CP/M's MAKEBIOS routine used to configure the system to your particular combination of disk drives. Briefly, we will edit the .ASM version of the BIOS in order to incorporate the changes necessary for it to work with FOREIGN.COM. Then we can assemble it to produce a working BIOS.SYS file. (I used CP/M's ED for editing. You can use any editor that can handle a 56K file.)

Once all the files are on the disk, do the following:

REN NEWBIOS.ASM=BIOS.ASM

If you will use CP/M's ED, then:

ED NEWBIOS.ASM

You are now in CP/M's editor with NEWBIOS as the file to work on. The asterisk is the prompt. Enter 1000A and insert the changes shown in Listing 2a for the SELDSK routine. (CP/M's documentation for ED outlines the process.)

NEWBIOS is larger than ED can hold in memory at one time. So you will have to go through the file piece by piece, writing earlier lines to disk (with nW, for write n lines) and adding later ones to memory (with nA, for append n lines). So, if you are using ED, you will have to do several nA's and nW's to get to the CBOOT routine. There, insert the changes for the CBOOT routine shown in Listing 2b. When the changes are done, enter an "H" after the prompt. When the prompt reappears, type "Q" and "Y" to get back to CP/M.

The next step is to make the new BIOS. Type the following:

SUBMIT MAKEBIOS A:NEWBIOS

Having the extension .ASM makes NEWBIOS available to the assembler, ASM.COM. The command line above runs the BIOS-generator program. Assemble this for H37 drives only. When the program is done, you have a BIOS ready to put on a SYSGENed disk.

Note: the first time the disk is booted, CONFIGUR.COM needs to be on the disk. The new BIOS should be renamed BIOS.SYS, set to SYS, and set for read-only (R/O) as outlined in the Heath CP/M manual. (See there the procedure for STAT.)

The BIOS that was just generated can be used on all disks now. It will have no effect unless FOREIGN.COM is run. Until

```
DRIVE2  LHLD    0001H
        LXI     D,19H
        DAD     D       ;HL POINTS TO SELDSK ADD
        CALL    HIHL    ;GET REAL ADDRESS
        LXI     D,09H   ;NUM DRIVES LOCATION
        DAD     D       ;IN MOD BIOS
        MVI     A,2     ;CHANGED TO 2
        MOV     M,A
        MVI     A,255   ;CHANGE LABEL READ FLAG
        STA     037H

;THERE IS NO LABEL READING NOW

        LXI     D,MSG2  ;PRINT TYPES
        MVI     C,PRSTR ;OF DRIVES
        CALL    BDOS
        LDA     TYPE
FORM1   CPI     31H     ;CHECK FOR MORROW
        JNZ     FORM2
        LXI     D,MORROW
        MVI     C,PRSTR ;PRINT MORROW DRIVE
        CALL    BDOS
        JMP     WMBT    ;WARM BOOT
FORM2   CPI     32H     ;CHECK FOR OSBORNE SINGLE
        JNZ     FORM3
        LXI     D,OSBSD ;PRINT OSBORNE SINGLE
        MVI     C,PRSTR
        CALL    BDOS    ;PRINT IT
        JMP     WMBT    ;WARM BOOT
FORM3   LXI     D,OSBDD ;MUST BE OSBORNE DOUBLE
        MVI     C,PRSTR
        CALL    BDOS
WMBT    LXI     D,MSG2A
        MVI     C,PRSTR ;PRINT IT
        CALL    BDOS
        JMP     REBOOT

;HL LOADED INDIREC THRU HL

HIHL    MOV     A,M
        INX     H
        MOV     H,M
        MOV     L,A
        RET


;MESSAGES TO BE PRINTED

CLEAR   DB      ESC,CLR,'$'

MSG1    DB      CR,LF,'WHAT TYPE OF DRIVE DO YOU'
        DB      ' WANT TO EMULATE',CR,LF,LF
        DB      '1  MORROW DESIGN',CR,LF
        DB      '2  OSBORNE SINGLE DENSITY',CR,LF
        DB      '3  OSBORNE DOUBLE DENSITY',CR,LF,LF,LF
        DB      'SELECT 1,2, OR 3   $'
MSG2    DB      CR,LF,'YOU ARE NOW LIMITED TO 2'
        DB      ' DISK DRIVES',CR,LF
        DB      'DISK A HEATH/ZENITH FORMAT',CR,LF
        DB      'DISK B $'
MORROW  DB      'MORROW FORMAT',CR,LF,'$'
OSBSD   DB      'OSBORNE SINGLE DENSITY FORMAT',CR,LF,'$'
OSBDD   DB      'OSBORNE DOUBLE DENSITY FORMAT',CR,LF,'$'
MSG2A   DB      CR,LF,'UNTIL A COLD BOOT$'
MSG3    DB      'SORRY YOU NEED VERSION 2.X OR'
        DB      'NEWER FOR THIS PROGRAM$'

NODRIVE DB      'NO SUCH DRIVE TYPE TRY AGAIN$'

;TEMP STORAGE AREA

DPEB    DW      0
DPEC    DW      0
XLATE   DW      0
DPBB    DW      0
TYPE    DS      1
RPSEC   DW      0
DENSTY  DW      0

;TABLE STORAGE AREA

;MORROW XLATE TABLE
MTAB    DB      1,2,3,4,5,6,7,8
        DB      25,26,27,28,29,30,31,32
        DB      9,10,11,12,13,14,15,16
        DB      33,34,35,36,37,38,39,40
        DB      17,18,19,20,21,22,23,24

;MORROW DISK PARM BLOCK

MDPB    DW      40
        DB      4
        DB      15
        DB      1
```

→

```
        DW      94
        DW      127
        DB      0C0H
        DB      0
        DW      32
        DW      2
;OSBORNE SINGLE DENSITY
;XLATE TABLE
OTAB    DB      1,2,5,6,9,10,13,14,17,18
        DB      3,4,7,8,11,12,15,16,19,20
;DISK PARM BLOCK
ODPB    DW      20
        DB      4
        DB      15
        DB      1
        DW      02DH
        DW      03FH
        DB      80H
        DB      0
        DW      16
        DW      3

;OSBORNE DOUBLE DENSITY DISK PARM BLOCK

OSDPB   DW      40
        DB      3
        DB      7
        DB      0
        DW      0B8H
        DW      03FH
        DB      0C0H
        DB      0
        DW      16
        DW      3

;DISK PARAMETER BLOCK FORMAT
;       DW      NUMBER SECTORS/TRACK
;       DB      BLOCK SHIFT
;       DB      BLOCK MASK
;       DB      EXTENT MASK
;       DW      DISK SIZE -1
;       DW      DIRECTORY MAX
;       DB      ALLOC VECTOR HIGH BYTE FIRST
;       DB      ALLOC VECTOR LOW BYTE
;       DW      CHECK VECTOR SIZE
;       DW      TRACK OFFSET

SPACE   DS      40
STACK   EQU     $
        END     100H
;CAUSES PC TO BE SET TO 100H AFTER ASSEMBLY
```

```
        LDA     037H    ;FOREIGN DISK FLAG
        ORA     A       ;TOGGLES Z FLAG ON ZERO
        JNZ     SETDSK3 ;SKIP LABEL IF NOT ZERO
;NOW CHANGE THE LINE THAT READS

        LDA     SETDSKD ;RESTORE BIOS MODE BYTE
;TO
SETDSK3 LDA     SETDSKD ;RESTORE BIOS MODE BYTE
;       (IT IS 2 LINES BELOW WHERE YOU WERE)
```

Listing 2a. In order to run FOREIGN, certain changes must be made to CP/M's BIOS. The lines shown here should be inserted in the .ASM version of the SELDSK routine, at line 835; it will go right after the CALL SHD instruction at location 01C5. (See page 29 of the Heath/Zenith BIOS listing.)

```
XRA     A       ;CLEAR A
STA     037H    ;INIT FOREIGN FLAG
```

Listing 2b. In addition to the BIOS insertion given in Listing 2a, these lines must be added to the CBOOT routine. This is to be placed right after the DI instruction at location 0C34. After insertion of the changes in Listing 2a, this will be at line 3675. (See page 124 of the BIOS listing.)

that time, the flag at location 37 hex is set to zero, so normal label reading is done.

Once the new BIOS is complete, the FOREIGN.ASM program in Listing 1 should be typed in. The listing has several notes throughout and explains what is being done in the program.

After it is typed in, name it FOREIGN.ASM and assemble it with ASM. ASM will then leave you with three FOREIGN files on the disk: FOREIGN.HEX, FOREIGN.ASM, and FOREIGN.PRN.

To produce a runnable .COM file, load DDT working on FOREIGN.HEX. When it loads, hit CTRL-C, and then type "SAVE 5 FOREIGN.COM". It is now ready for use. Or you can just type "LOAD FOREIGN". DEBUG will load the hex file and create a .COM file.

I hope this program will help you learn a little more about CP/M's ED, DDT, ASM, and the DPE and DPB tables—as well as opening doors to more programs.

You may not want to type in the program. For $15, I would be more than happy to mail a disk with the following on it: FOREIGN.ASM, FOREIGN.HEX, FOREIGN.PRN, FOREIGN.COM, and FOREIGN.DOC.

Ordering Information

FOREIGN files, $15.
(Cashier's check or money order.)
Dennis Shackleton
c/o Mary Shackleton
4990 Harmony Drive
Oscoda, MI 48750

Other Reading

The Soul of CP/M
Michael Waite and Robert Lafore
Howard W. Sams & Co.
4300 West 62nd Street
Indianapolis, IN 46206
(Condensed in *Computers & Electronics*, May through August 1983.)

Mastering CP/M
Alan R. Miller
Sybex, Inc.
2344 Sixth Street
Berkeley, CA 94710

The Programmer's CP/M Handbook
Andy Johnson-Laird
Osborne/McGraw-Hill
2600 Tenth Street
Berkeley, CA 94710

"Building a Hard-Disk Interface for an S-100 Bus System"
Andrew C. Cruce and Scott A. Alexander
Byte, March, April, and May 1983
Byte Publications, Inc.
70 Main Street
Peterborough, NH 03458 △

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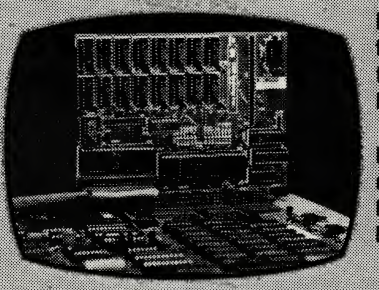

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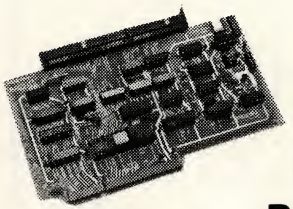

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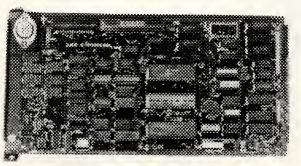

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Circle #108 on Reader Service Card

Weighing the Merits of the Z160

It's a fine computer, but don't try to carry it far.

Wayne Rash, Jr.

Photo courtesy of Zenith Data Systems

Somehow, I think it must have been inevitable. Who besides a company that has spent decades building television sets would think of a 19-inch color TV as "portable"?

In this case, it's the same company that calls a computer that tips the scales at nearly 42 pounds "portable." Not that there's anything wrong with the computer, mind you—it's just that it adds a whole new dimension to the definition of the word "portable."

As a computer, the H/Z160 is identical to its (lighter) desktop sibling, the H/Z150. Even though the '160 *looks* a lot different, those differences are more related to mechanical arrangement than to electronics. The same backplane holds the same circuit boards in place in both computers. There are some differences in the frames, due to the stresses involved in carrying the '160.

The more noticeable differences are in the top-mounted disk drives and in the placement of the built-in 9" amber monitor. You won't find a Winchester disk drive on the top of the '160, however. I understand that Zenith engineers are of the opinion that portability and hard disks don't mix.

Assembled, a '160 with one 5¼" drive listed at $2,399 in the Spring 1985 Heath catalogue; with two drives, $2,999. (The kit versions listed at $1,699 and $1,999.)

The hardware

The '160 does quite well in its role as one of Zenith's answers to the IBM Personal Computer. It is very close to being totally compatible with the IBM, and may be as compatible as is IBM's own portable. It is certainly more hardware compatible, since you are not required to outfit your '160 with half-sized cards for some of the slots.

More importantly, the '160 is completely compatible with the rest of Zenith's "Z100 PC" series of computers, meaning it's identical to the Z150. In fact, there is no difference between the two computers except for the case and the monitor. It's the case that will affect your life with a '160 the most.

The first thing you'll notice about the '160 is the placement of the disk drives. They are in a small separate chassis that mounts to the top of the computer. The rear of this chassis is hinged, and when in use the drives are tilted up. The drive chassis will lock either in the tilted position or flat against the top of the computer.

The monitor is to the right of center on the front of the computer. The amber monochrome screen takes the place of the add-on monitor unit that you would use with a '150. As with the '150, you can attach a color monitor by simply plugging it into the connector in the rear. There is also a connector for composite video on the rear of the computer, so you can attach a larger monochrome monitor if you wish.

When the '160 is being prepared for travel, the keyboard is attached to the front of the computer, covering the screen. A section of the front panel of the computer will slide aside to reveal a storage space for the keyboard's coiled cable. The power cord has a storage space in the disk-drive chassis, next to the right-hand drive.

The rear of the computer is not nearly so well protected as the front. In fact, when you set the computer down, it rests on its rear; the vulnerable connectors located there are only fractions of an inch away from whatever you are setting the computer on.

While you would not (I hope) set this computer in a puddle, that will not free you from the likelihood of damage to these delicate parts. If you set the '160 down on the carpet at home, for example, you should check closely for fuzz in the connectors afterward.

This problem with the rear of the computer should not be taken lightly. Since this is a computer that is designed for travel, it is likely that you will take it travelling. This means that you are going to be setting it down in a variety of places, not all of them clean and dust free. There should be some provision for protecting the rear of this computer, even if it is in the form of an optional fabric carrying case with a hard bottom.

(Others seem to have come to much the same conclusion. EDL Products & Services, of Roseville, Minnesota, offers

a protective back panel for $9.95 and a vinyl cover for $29.95.)

Before we move to the inside of the '160, I should mention the handle. The computer is carried with its screen facing up, as I mentioned above. The handle is attached just behind the screen. And when it's not in use as a handle, it serves to hold the computer in a slightly tilted position.

The handle appears to be very sturdy; but in this case appearances will deceive you. During the time I had the Z160 used for this review, the handle began to disintegrate from the stress of travel. In defense of the '160, I should mention that some of the stress of travel included the Skycaps at Washington National Airport—a group that can overstress nearly any handle.

In any event, I was able to repair the handle, and it provided adequate service.

Inside the transpushable

Before we can take a look inside, we must first open the computer. This is more of a trick with the '160 than it is with the '150, mostly due to the location of the disk drives on top of the computer. Before you can remove the computer's cover, you have to remove the disk drives.

Getting the drive chassis off looks a lot harder than it is. The front of the drive chassis is held in place by two spring-loaded supports; these also serve to hold the drives at an angle so you can reach them. You press these supports to the rear of the computer while lifting up on the drives; then the drive chassis detaches at the front and pivots to the rear.

The rear of the drive chassis is hinged so that it can be removed when it swings to the rear of the computer. You also have to unplug some cables before you can remove the drives completely. There are two power cables that are held together with plugs, a data cable that plugs into a similar cable that emerges from the inside of the computer, and a ground lead that attaches to the center frame support.

Lift with your legs, and not your back.

Once all of that is accomplished, you can set the disk drives aside. Make sure you note how the power cables connect, so that you can re-attach them properly.

Now that the disk drives have been removed from the '160, all that stands between you and the inside of the computer is the top cover. This is held in place with four screws. Once you remove these, you can remove the cover, and you're inside.

If you had both a '150 and a '160 side by side at this point, you'd probably notice that the inside of the '160 looks a lot like the '150. About the only difference that you'd notice right away would be that the cathode-ray tube (CRT) for the monitor has taken the place of the disk drives on the '150. The expansion slots and the backplane that distinguish the desktop '150 are still there.

The slots

The Zenith backplane has eight IBM-compatible expansion slots. Four of these are taken up with the central-processing unit (CPU) board, the disk controller, the video board, and the memory board.

The memory board comes with 128 kilobytes of random-access memory (RAM) installed, and with enough room for a total of 320K. If you buy the assembled '160 with two disk drives, you will also get the full 320K installed.

The boards also have additional functions, such as providing the parallel and serial ports. When you get the '160, you will have a complete machine. So you won't have to go around buying extra boards and peripherals just to make your computer work.

The four open slots will take nearly any expansion board that will work in the IBM PC, including the IBM's monochrome board. Since this is a portable computer, it makes sense to use some of that space for a modem board, for example, or some other function that might otherwise be assigned to a stand-alone peripheral. Still, the '160 comes with most of what you need in a portable. So you are not likely to need to fill all of the slots in the '160, especially since there's no hard disk available.

Diagnostics

One of the more likely reasons that you might have the cover off the computer is that you're trying to see what goes on inside. Zenith has made this job a little easier for you. Located on the CPU board is a row of five light-emitting diodes (LEDs) that light up as the system's read-only memory (ROM) boots the computer. They light up in sequence as the boot ROM touches base with various hardware elements. So, if the system fails to run the operating system, you can look at these LEDs and tell where the failure occurred.

With the '150, that process is pretty simple. You take the top off the computer and try to boot the system. As this takes place, you can watch the LEDs.

Since you have to remove the disk drives to enter the '160, this is a lot more cumbersome. As far as I can tell, you have to hold the disk drives in your hand if you have the top off while the system starts running.

You might be able to set the drive unit down on top of the '160's frame. But that puts you fairly close to the monitor and

Circle #242 on Reader Service Card

Circle #133 on Reader Service Card

Circle #151 on Reader Service Card

Authors:

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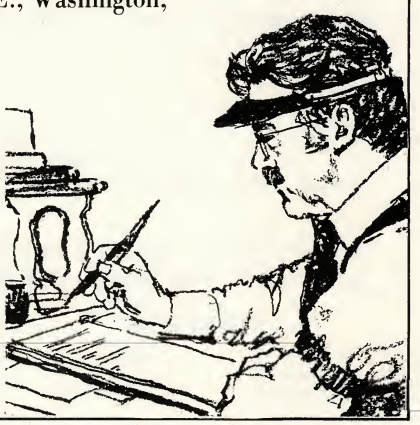

its high-voltage power supply. That's perfectly all right if you want to see if there's sufficient electromagnetic radiation to bother your disks. I decided not to try it.

The ROM that comes with the '160 includes an excellent set of diagnostics. The ROM also contains routines for generating color bars, for manipulating memory, and for assembling and disassembling programs.

Using the '160

Let's assume that you've just returned from a trip, and you need to use your '160. Before you can use it, you have to set it up. Making sure that you lift with your legs, and not your back, take a deep breath and lift the computer to a sturdy table.

Set the machine down gently. Tilt it over so that it rests on its bottom, and the handle is beneath it. Make sure you check the connectors on the back for carpet fuzz.

The keyboard covers the screen when the computer is being carried, but two latches serve to detach it. There are two legs at the rear of the keyboard to let you adjust its angle. As I mentioned earlier, the coiled cord for the keyboard is stored behind a sliding panel next to the screen.

You hook up the keyboard by plugging the cord into the left side of the keyboard, and the other end into the rear of the computer. This cord is about ten feet long, so you can lean back and put your feet up and still use the computer.

Before you can raise the disk drives, you have to slide back a small panel that closes the space between the drives and the front of the computer. Once this is done, the drives will pop up when you release the two latches holding them. As they swing up, the drive supports snap into a locking position. You'll find the power cord in that pigeon hole next to the right-hand drive.

The power cord plugs into a receptacle on the rear of the computer, and of course into a power outlet. Under autoboot, all that's required to start the computer running is a disk containing the Microsoft Disk Operating System (MS-DOS). Place the disk into the left-hand drive, turn on the switch on the rear of the computer, and the machine should start running. If it does not, now's your chance to use those diagnostics I mentioned earlier. Otherwise, you will see the sign-on message of MS-DOS, and the computer will be ready for use.

The keyboard

I've already discussed a little bit about the keyboard, enough to get the '160 set up, but there's more you should know. In use, this is an excellent keyboard. It's a lot better than the one on the IBM PC that the '160 emulates. The most obvious improvement is in the layout. Unlike the IBM, the '160 has a traditional typewriter layout for its keys.

There are other improvements as well. The Caps Lock and the Num Lock keys have LEDs in them. Now you can tell at a glance when your Num is Locked.

The keyboard is much quieter, since it has dispensed with the clattery sound that distinguishes the IBM. There is an electronically generated key-click that you can turn off if you wish. I found that the feel of the keys was nearly as good as on the Z100, and much better than on most of the other IBM compatibles.

Screen sharpness

The '160's built-in 9" amber monitor is easy to read, and it seems to have excellent resolution. Part of this is due to the relatively small size of the screen, of course. The video board supports IBM color graphics, although you'll see them as shades of amber unless you have a color monitor attached.

The screen is able to scroll very smoothly. There is none of that flickering that is so irritating on the IBM. There is even a special smooth-scrolling routine built into the '160's ROM. This capability is shown on the computer's demonstration disk, and is very impressive.

Compatibility

Despite the rumors you may have heard to the contrary, the '160 is not 100% IBM-PC compatible. It's close, but there are a few programs that will not run properly. In nearly every case, these problems are related to the use of half-height disk drives in the '160.

One of the most irritating problems I had recently was with an early version of WordStar 2000: I could not run the installation program to set things up for my printer, etc. It seems that the copy-protection system on the IBM-PC version of WordStar 2000 didn't like the drives on the '160. If you tried to install WordStar 2000, part of the installation program would get erased, and the disk would be useless.

MicroPro International, the publishers of WordStar, have since removed this copy protection; the new version runs fine in the '160.

While you no longer have to worry about WordStar 2000, you do need to keep an eye on other copy-protected software. The schemes that allow copy protection tend to be extremely specific about the hardware they use. You'll be interested to know that even some IBM PCs aren't compatible enough to work with some of these programs.

There are also a few scattered problems with other products designed for the IBM. Concurrent CP/M with Windows has problems with the '160's disk drives. Also, there are a few accessory

circuit boards that get confused by the '160's memory's being as large as 320K. I'd recommend that you get return privileges from your dealer before you buy anything.

For the most part, everything runs fine. The problems I mentioned above were the only problems I was able to find, despite an intensive search.

The programs that are usually considered benchmarks for compatibility ran fine. Microsoft's Flight Simulator had no problems; neither did Ashton-Tate's Framework. Programs written to run in IBM's BASICA will operate perfectly with Zenith's GW-BASIC.

The operating system

The '160 computer has MS-DOS 2 as its standard operating system. As far as you and the software are concerned, it seems to be exactly like IBM's PC-DOS. You also get a disk with MS-DOS 1.25, in case you have a program that will not run with MS-DOS 2. Both of these operating systems are included with the '160 when you buy it. You also get a full set of utility programs.

While MS-DOS seems to be just like the IBM version of this product, the utilities that come with it go beyond anything that IBM is offering. If you are familiar with the release of MS-DOS 2 that Zenith is offering for the Z100, you will be familiar with most of these. They serve to make the operating system more useful than it is with the IBM PC.

Some of these utilities are descendants of earlier utilities that Zenith has distributed with its computers.

RDCPM, for example, resembles the version that originally was included with the Z100. In this case, however, it will read both the Z100's version of CP/M and the CP/M-86 intended for the IBM PC and compatibles.

CONFIGUR is also an old Zenith standby. In this case, about all you can do is set up the communications ports, and tell the operating system if you're using a serial printer as the system list device.

Some of the new utilities that Zenith has added to the MS-DOS operating system include CIPHER, which will let you encrypt data and programs. This utility is useful when you must let several people have access to the machine, but don't want to lock up the disks. The CIPHER documentation shows refreshing humor in manual writing, using examples such as files named CIASPY.DAT or WATRGATE.BRK.

The PSC utility will allow you to print the screen on the system printer, as most other MS-DOS machines do. But, unlike most others, the Zenith version supports a number of printer brands besides the company standard.

You can use the SEARCH program to get a representation of the directory structure of your disk. (Subdirectories are indented.) This is a valuable feature if you have a hard disk and many subdirectories. On the '160, it's of limited usefulness.

When you find what you are looking for, you can compare it with another file using the FC program. FC will allow you to compare either text or binary files for differences.

(For more on MS-DOS version 2, see my review in *Sextant* #17, July-August 1985, "Moving up to MS-DOS 2.")

Documentation

Even though the manuals that accompany the '160 are not as voluminous as those that came with the Z100, they are still among the finest in the industry. The MS-DOS manual has been rewritten (some say translated) and is quite usable. It is good enough, in fact, that I was forced to refer to the manual for the '160 when stumped by the manual that came with an AT&T computer I was reviewing for another magazine.

Check the connectors on the back for carpet fuzz.

The MS-DOS manual has a few notable improvements over similar manuals from other companies. In the reference section, for example, there are explanations geared to the new user, and separate explanations geared to the experienced programmer. The manual is carefully indexed, and it has a complete table of contents.

The manual is bound in a three-ring notebook. But rather than the full-sized binder of years past, it is the newer half-sized binder. I appreciate the smaller size, especially due to the crowded nature of my desk. This does result in a thicker book, though, which can be a little difficult to handle.

The hardware manual is in the same size binder, although it isn't as thick. This manual is divided into two parts, the User's Guide and the reference section. The User's Guide is designed as a booklet in its own right, and will serve to get you familiar with the equipment. The rest of the manual will give you more detailed information.

This manual does not reach the level of detail that has accompanied other Heath/Zenith computers. You can get more information if you get the kit version of this computer. However, most users will find adequate information for most operations here.

Portability

A portable computer does you little good if you can't move it around. It also does you little good if moving it does so much damage that you'll break it if you move it. When it comes to making a

computer that you can carry around, there always seem to be compromises; and how they are approached can affect a computer's portability greatly.

I have poked fun at the '160's weight and dimensions earlier in this review. I did this because the '160 is big and it weighs a lot. On the other hand, it is substantial enough that you are unlikely to damage it by carrying it from place to place.

Just how big is it? According to Zenith, the '160 measures 19½" x 8⅜" x 19⅛".

That's big enough that it won't fit under the seat on an airliner. I checked it with a luggage gauge provided by Trans World Airlines, and found it to be too large to be carried on one of their planes. Fortunately, TWA relented and let me take the '160 on board, anyway.

I was relieved to find that it fits precisely the overhead luggage bin on a TWA Boeing 727. I'm not sure that the flight attendant was relieved to see me lifting an object over the heads of other passengers when it was obviously so heavy.

(For those of you who are interested in these things, TWA allows objects measuring 21" x 8" x 16" to be placed under airline seats. To be carried on board as hand luggage, an object must weight less than 70 pounds, and measure less than 45" in combined length, width, and height. The '160 just misses passing either test. Other major airlines have similar restrictions.)

Weight is as much a consideration as is size. To get the '160 onto the airplane, you have to carry it. According to Zenith's specifications, the '160 weighs 39 pounds. I weighed the review unit with two disk drives, both cords, and two disks in the drives and found the unit weighing 42 pounds. While this is within the limit allowed by the airlines, carrying a 42-pound computer through most airports is enough to make you switch to rail travel. The weight of the unit astounded more than one Skycap.

While the '160 is quite capable of surviving the indignities of air travel, you may find it too much of a burden. The size and weight problems aside, the design limitations show insufficient consideration to the needs of the traveller.

I mentioned the problem of the bottom of the '160 earlier. When you set the machine down, the communications ports, the switches and the monitor connectors are all a fraction of an inch from the surface the computer is resting on. This means that you have to be very careful where you set it down. A dirty floor or maybe even a shag carpet could seriously damage your computer.

The handle of the '160 creates problems in two areas. When folded, it takes up extra space, making the computer more difficult to stow. Also, it is only marginally able to handle the stress of travel, as I found out when it started to come apart while I was travelling. I think that a soft, flexible handle like the one used on the Compaq portable would serve the traveller's needs better.

It seems to me that the '160 is more suited to being portable in the office environment. This is the sort of machine that is convenient to move between neighboring offices when you need to share a computer. Considering the ruggedness of its construction, the '160 should excel at this task.

The '160 is even a good idea for someone who has to take it along in an automobile, provided the car isn't too far away. It just isn't suitable for the business traveller who plans to use the airlines.

Conclusions

The '160 isn't the answer for most people's needs when they think of a portable computer. This is primarily because it just isn't very portable. Otherwise, it is a fine computer, one of the best of the IBM-PC compatibles.

The '160 will do just fine if you need a PC clone that you have to move occasionally. If your primary requirement is compatibility with the IBM, however, you'll probably like the '150 more, since it fits the desktop environment a little better.

I was not overly taken with the practicality of owning a '160. It seems to be one of those compromises where too much was given up in the rush to get the machine to the market. That's too bad, because this is really a fine machine trapped in a second-rate box.

Ordering Information

Waterproof vinyl cover, $29.95.
Protective back panel, $9.95.
Both together, $34.95.
Add $2.50 for shipping.
EDL Products & Services
453 South McCarrons Boulevard
Roseville, MN 55113
612/489-0851 △

Whither the '160

By the time you read this review, the Z160 will be in its final days. It may be that the final day has already been chosen. As this is written (in May 1985), there have been rumors circulating that the Z160 has received its death notice, with the sentence to be executed in July of 1985. Zenith Data Systems (ZDS), however, assures us that prior commitments will keep them manufacturing the '160 until the end of the year.

Regardless of the exact date at which they stop manufacture, though, the Heathkit version of this machine will probably remain longer, since the current inventory of kits should satisfy demand for a while longer. They wouldn't be making any more of them, however.

What would the '160's demise mean to you? Maybe a good price on an IBM-PC compatible computer. Past practice at Heath/Zenith indicates that the company will mark down the remaining stock to make room for the newer lines. And if you're a kit builder, you may eventually get a *very* good price.

The hope at Zenith is that their newer lines of portables will sell better than the '160 did. Their specifications give them a better chance. (See *Sextant* #17, July-August 1985, "ZDS Introduces Five New Computers.") There is still the question of whether the public is ready for yet another portable computer; but that question can only be answered in the marketplace.

The new models

Heath/Zenith announced two new portable computers in May. One of these is similar to the '160 in function, but it's smaller and lighter. In short, this is what the '160 should have been. This computer has a 7" screen, and it weighs about 25 pounds. Oh, yeah... and it will fit under an airline seat.

This computer is designated the H/Z138. It will most likely be marketed as the successor to the '160.

A more exciting development is an even smaller portable with the Zenith nameplate. This is the Z171, a 15-pound portable with a liquid-crystal display (LCD). Based on the Pivot from Morrow Designs, Inc., it will be manufactured by Zenith.

Morrow got around the problems that most LCDs have by backlighting the display. If done properly, this screen should be very easy to read.

From what I can tell right now, this computer will be a significant improvement over similar models. You won't have to contend with non-standard disk drives or hard-to-read displays, as you do in the DG/One by Data General, for example.

Will the consumers buy portable computers? I would like to think that they will. But it will take more than excellent performance to bring in the sales—as the '160 has shown.

A Look at SigmaSoft's Interactive Graphics Controller

Along with high-resolution graphics, SigmaSoft's board offers an eight-port parallel interface and a RAM disk.

Kenneth A. Patrick

If you are the owner of a venerable H/Z89 or '90, you belong to a group of folks who'd rather fight than switch to another machine. In spite of the advances in technology, this machine continues to grace the workstations of those "in the know."

However, the siren song of high-resolution graphics is threatening to bring the '89's life cycle to a close.

Third-party vendors, though, are still introducing hardware and software designed to keep the '89's obsolescence at bay. Two years ago, SigmaSoft and Systems introduced a parallel interface board with software to allow owners to use less expensive (and faster) parallel printers.

That card was just the first stage of a much more ambitious project: a high-resolution pixel-graphics board. With its introduction in August of 1984, SigmaSoft gave '89 enthusiasts an alternative to trading up to an H/Z100 or H/Z150.

SigmaSoft's Interactive Graphics Controller (IGC) is an add-on peripheral board that expands the capabilities of the '89. With each day of ownership, I've found more ways to make it useful. It's not a dedicated device, able to accomplish just a single task, but a useful extension to the system, a tool.

SigmaSoft also markets an H8 version of the parallel-interface board. The IGC system can be installed in an H/Z19 as easily as in the '89 and '90. If you have a Heath/Zenith terminal, that means your H8 is *not* obsolete, regardless of whether your H8 has an 8080 or a Z80 central processor unit (CPU). The installation differs between the '8 and '89 versions, but H8 owners can get all the benefits discussed in this article.

The ability to address single dots of light on the screen (or picture elements—pixels) is just one of many advantages you'll gain with the IGC.

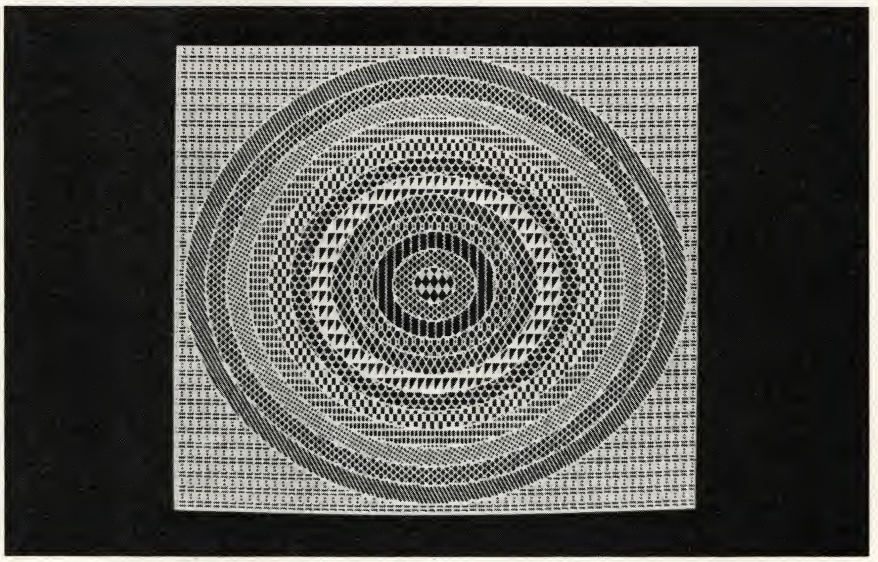

Photo courtesy of the author

Let's talk about the graphics first, though.

The '89 screen has a standard resolution of 80 characters by 25 lines. Independent vendors offer several sets of read-only memory (ROM) chips to control the character set the '89 displays. Using one of these ROM sets with modified graphics characters, a "medium resolution" is possible: 160 by 50 addressable blocks.

These blocks might be referred to as pixels, even though they are each made up of many dots of light. Each character on the standard 80 by 25 screen, however, is made up of an 8-wide by 10-high array of dots.

The '89's video board has enough random-access memory (RAM) to store a single byte (eight bits) of data for each character displayed, for 2,000 characters in all. The video controller board creates the character patterns using the character ROM as a guide (with a maximum of 256 different patterns).

To gain control of *every* dot on the screen, you'd need a "bit" of RAM to indicate the on-off state of its corresponding pixel. Simple multiplication (80 x 25 x 10 x 8 / 8 bits per byte) indicates that 20,000 bytes of RAM would be required to fully map the video screen.

To take that much RAM from the normal workspace would be a hardship. SigmaSoft's IGC has its own RAM space, a full 64 kilobytes standard; this can be logically divided into three "pages" of video memory. Software can select both the page to be displayed and the page upon which read/write operations are effective.

What you get—the hardware

In the fall of 1984, a year after I saw the prototype, I got my board, the third one made, and only the second one in regular production. Since it was still a pre-release version, I got sketchy installation instructions and an incomplete user manual. Nevertheless, I had the

new board running within two hours. If you built your '89, installing this rig is a piece of cake. If not, here's a good time to get inside.

There are three basic components: the IGC board itself; a new auxiliary power supply; and SigmaSoft's now-venerable eight-port parallel interface (which mounts in one of the 89's left-side expansion positions). Those who have already purchased the parallel board can save $95 on the IGC package.

The IGC requires six of the parallel board's eight input/output (I/O) ports, leaving two for your own use. SigmaSoft provides parallel printer driver software if that's how you wish to take advantage of one of the ports. The parallel interface board installs easily on the leftmost bus connector. A single chip is removed from the CPU board, and a cable from the parallel board takes its place.

The power supply is recommended if you have lots of boards in your '89 already. You have the option of deleting it for credit, but why tempt fate by overloading your existing supply? To install the new one, you must remove your internal drive and the large blue power capacitor mounted in the base of your machine.

I re-mounted the capacitor on the new power-supply board, and the new board eased back into the base plate like a knife into its sheath. No soldering is required: you unplug the fan, plug its cable into the new supply, and run a new cable (supplied) back to the fan. Just replace the drive and you're done.

The IGC board is nothing less than a work of art. Mounted on two stainless steel hinged brackets, it neatly installs horizontally between the front panel and the CPU board, over the top of everything else. The hinged bracket allows access to your machine's innards. (See Figure 1.)

This location blocks the left air slots in the cover, which might seem unwise. But Clay Montgomery, the IGC's designer, contends that it actually improves cooling. That's an opinion others share.

The IGC requires cable attachments to your machine at several points. Again, no soldering is required, just removal of chips to allow cables to be plugged in. (Needless to say, observe the standard cautions to ensure you don't zap anything with static electricity.) One harness has four plugs for the terminal board, and another has a plug for the parallel board. Both cables attach at the rear of the IGC board to allow it to hinge.

As noted, the IGC comes standard with one 64K bank of memory. You can expand that to 128K by piggybacking memory chips on top of one another—or to 256K by putting in 256-kilobit RAM chips.

Being a guinea pig for the second production board, I chose to install my own 128K memory expansion. I recommend that you let SigmaSoft install it for you. The soldering, etc., is a pain. Besides, you might end up with marginal chips, as I did.

The expansion buys you double the IGC's normal resolution for bit graphics by allowing optional interlaced video, and you can have 128K of RAM disk rather than 64K. When the price came down for 256-kilobit chips, I upgraded my board for a rather effective RAM disk, with the option for graphics and/or spooling.

. . . *and the software*

Hardware freaks usually get lost in esoteric solutions to electronic problems, and forget Joe Average isn't on the same level. I bought a sophisticated serial/parallel/real-time clock board for my '89 several years ago. It took weeks to write my own software to access the clock. I have never tackled the parallel port for a printer. Thus it was with some trepidation that I opened the software guide for the IGC.

No problem. SigmaSoft has broken the facilities you need into three neat software packages, included with the board. These packages come in versions for CP/M and the Heath Disk Operating System (HDOS).

Graphics commands

In the descriptions below, the name of each command is given first in **boldface**, followed by a dash. The form of the basic command is shown in boldface; options follow immediately in *italics*. The form of a command shown below (e.g., A for Arc) is the minimum needed. IGC, however, will also recognize longer forms. (AR or ARC will also work.) Except where noted with an asterisk, an equal sign (=) may be substituted for the x,y coordinates; this invokes the current cursor position. Also, using a number-sign prefix (#) specifies relative positioning rather than absolute.

Arc—A x,y,r1,a1,a2,*r2,r3,...,rn*
Draw an arc (or series thereof). Drawing modes Erase and Toggle are honored, as well as Scale.

Here, x,y is the radius center; a1 is the starting "degree" of the arc (1-360); a2 is the ending "degree," drawn counterclockwise; and r1,r2,...,rn is the radius of each arc to be drawn.

Box—B x1,y1,x2,y2,*...,xn,yn*
Draw a box (or series thereof) based on the coordinate pairs provided, using the current line STyle and Erase and Toggle modes.

Circle—C x,y,r1,*r2,...,rn*
Draw a circle (or series thereof) based on the center and radius (or radii) supplied. Erase and Scale modes are honored, STyle and Toggle are ignored.

Here, x,y is the center of the circle; r1...rn is the radius of each circle to be drawn.

CLear—CL
Clear all graphics pages to the currently selected CLear style. (See STyle.) Much faster than Erase, but limited in styles and scope.

CUrsor—CU x,y or **CU ON** or **CU OFF**
Control the graphics cursor, a crosshair that automatically overlays your graphics image. Used in developing your own interactive graphics tools.

DIsplay—DI p or **DI s** or **DI p,s**
Select one of three pages of graphics memory to display on the screen.

Here, p is a number (0-2) representing the screen to be displayed. Some limitations exist for the various hardware interlace options; s is an optional scan line number (0-255) from which to begin display. The s allows simple smooth scrolling or small vertical adjustments of the displayed image.

If DIsplay is used properly with the Draw command, you can "hide" the actual construction of a screen. Just Draw your design on a page that's not being displayed on the screen; then DIsplay the page only when it's completed.

DOt—DO x1,y1,*...,xn,yn*
Place a single pixel dot at the coordinates specified. DOt honors the Erase and Toggle modes. Both absolute and relative addressing are available.

Draw—D p or **D s** or **D p,s**
Select the video page on which graphics commands are to take effect. (See DIsplay.)

Erase—E x1,y1,x2,y2,*...,xn,yn* *
Erase one or a series of rectangular areas on the current drawing screen. Erase replaces all pixels in the defined area with the current PAint style (whether or not that's the background color).

Here, x1,y1 defines the upper left corner of the rectangle; x2,y2 defines the lower right corner.

Additional rectangles can be cleared with additional sets of four coordinates.

Get—G x,y
Get a video image "word" (16 bits) from the address specified on the current drawing page.

IG: and IGC:—These are HDOS and CP/M modules that provide a high-level interface to control the graphics device. They are controlled by ASCII commands sent as if to a sequential file.

PD: and PDC:—These are HDOS and CP/M high-speed pseudo-disk drivers. Access to each is as though it were a standard disk drive, complete with directory. Under HDOS, you can even reboot from the pseudo disk.

SP: and SPC:—IGC also comes with HDOS and CP/M RAM spooler software that frees up your system during interminably long printouts. Under CP/M, the driver actually intercepts output to the logical LST: device and reroutes it to the spooler.

SigmaSoft provides printer support software for both HDOS and CP/M-80. Clever programming by SigmaSoft provides HDOS-like device drivers under CP/M, which even include the SET command.

Each module has options to specify which of your four possible memory banks are to be used. The IG: module has screen-dump support for most popular printers, including I.D.S., Epson, M.P.I., Okidata, Mannesmann Tally, and C. Itoh printers, with more coming.

The CP/M drivers are installed into RAM using SigmaSoft's LOADD.COM program. This can place the module into RAM above the operating system if you have reserved space for it; or it can place it just under the operating system, adjusting memory pointers accordingly.

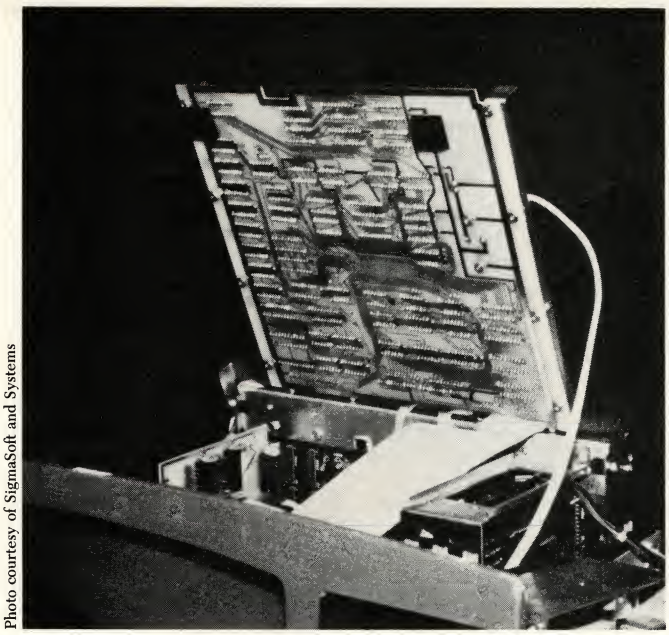

Photo courtesy of SigmaSoft and Systems

Figure 1. The IGC board can be flipped up, allowing access to your machine's innards.

You get a RAM disk

You thought this was a review of a graphics controller, right?

Well, if you're like me, you won't use graphics more than 25% of the time, probably less; the rest of your time is used for more productive things like compiling programs, bookkeeping, etc. Using software included in the purchase price, the IGC can double as a very fast RAM disk under both HDOS and CP/M.

There's nothing like seeing HDOS boot in less than two seconds, or a PL/I compile running at RAM speed, all in total silence. One practical use I have is

GO—GO x,y
Set the "current" coordinate to the defined pixel address.
Input—I Left or **I Right**
Read status from one of the two optional input devices (e.g., joystick, trackball).
Line—L x1,y1,x2,y2,...,*xn,yn*
Draw one or a series of lines between the coordinate pairs specified, using the current STyle, Erase, and Toggle settings.
Mode—M+ ⟨options⟩ or **M– ⟨options⟩** or **M= ⟨options⟩**
Set and clear various graphics-driver settings. A prefix toggles the mode on (+), off (–), or "exclusive" (=) (which sets all other modes not mentioned back to default settings).

The options are: P (Pixel) high-resolution graphics mode; C (Character) normal text mode; I (Inverse) same effect in graphics as H/Z19 and '89 inverse video; A (Alternate) use available alternate character set; E (Erase) plot "black" dots instead of white ones; and T (Toggle) reverse the state of each pixel addressed.
Origin—O C or **O B** or **O T**
Define the coordinate system desired.

With C (Center), point (0,0) is the center of screen; left is –x, down is –y, range is (–320,–249) to (320,249). With B (Bottom), the lower left corner is point (0,0); right is +x, up is +y,; range is (0,0) to (639,499). And with T (Top) the upper-left corner is point (0,0); right is +x, down is +y,; range is (0,0) to (639,499). T is the same as the '100's coordinate system; it's not recommended by SigmaSoft except for compatibility.
PAint—PA x1,y1,...,*xn,yn* *
Fill any outlined regular or irregular polygon with the current PAint Style, beginning at the coordinate(s) specified. The object *must* be completely outlined by a *solid* border, or the PAint will "bleed."

The state of the defined pixel specifies the color of the area(s) to be PAinted, and the opposite color is regarded as the border color. A new feature is the ability to define a private PAint pattern in addition to the 49 STyles supplied. (See PATtern, below.)
PATtern—PAT n1,n2,...,n7,n8
Set private bit-map pattern for PAint STyle number 50; using an 8x8 dot matrix, eight decimal numbers specify separate lines of the pattern.
PRint—PR or **PR p,s**
Output the current display page to a supported dot-matrix printer. Here, p is the desired page to be dumped; and s is the scan line from which dump is to commence.
PUt—PU x,y
Write a binary "word" (16 bits) at the coordinate specified on the current drawing page.
Reset—R
Reset the device driver to its default settings.
SCale—SC x,y
SC can be used to re-scale objects drawn using the relative addressing option. All relative coordinates supplied by the program after this command are rescaled by the supplied factors. Absolute addresses will not be affected.

Both x and y are integers. If x or y is negative, the resulting image has the appropriate axis "flopped."
STyle—ST s0,s1,s2
Selects the styles of lines and fill patterns used by subsequent graphics commands. Here, s0 is the line style, one of 12 (dots, for instance, or dashes); s1 is the area paint styles, one of 50; and s2 is the clear (rectangular) area styles, one of 4.
Test—T x,y
T returns a value of "0" or "1" for the "black" or "white" state of the tested pixel.

PL/I-80 Compile Times

Source Drive	Compiler Drive	Elapsed Time
Z37	Z37	2:00
RAM	Z37	1:15
Z37	RAM	1:48
RAM	RAM	1:03

LINK Times

LINK Libraries	Object Files	Elapsed Time
Z37	Z37	2:54
RAM	Z37	1:42
Z37	RAM	2:37
RAM	RAM	1:03

Table 1. Comparative times (in minutes) for compiling and LINKing a PL/I-80 program (under CP/M) with the program files on the Z37 floppy-disk drive and on the Interactive Graphics Controller acting as a RAM disk.

to load my master file catalog into the RAM disk while I'm doing my library maintenance. I can scan the whole 120K file with lightning speed, as many times as I wish, using an ordinary search utility.

How much performance can you expect from the RAM disk? Even a 256K RAM disk can limit you, since it is a fixed resource. To make it most effective, I found it a good policy to place only my most active files on the RAM disk.

A compile and LINK of a PL/I-80 program under CP/M is a good, reasonable exercise. By experimenting with different files on RAM disk and alternating the "default" CP/M drive, I got some surprising improvements over the floppy drive. The results are given in Table 1.

You can't boot the RAM disk (drive M:) under CP/M, but you can log onto it as the current drive. Under HDOS, the drive is PD0:. Examining the RAM disk with SZAP, a disk-dump utility from The Software Toolworks, reveals that it produces a convincing directory under either operating system. You can configure the RAM disk to use up to 256K. Or you can use selected 64K banks of the IGC memory, to allow other banks to be used for graphics and/or spooling. In any case, you'll see a significant improvement in the speed of I/O using the RAM disk.

And fast graphics

Enough about the RAM disk for now. The IGC is billed as a graphics device, and it fits the billing.

Having had a Z100 for the last two years encouraged me to make comparisons. Leaving the graphics aside, most will agree that an '89 with a 4-megahertz speed-up will run circles around the '100. It doesn't matter whether the '100 is running CP/M, CP/M-86, the Zenith Disk Operating System (Z-DOS), or even Newline Software's '100 emulation of HDOS.

Mind you, I'd never give up my '100's 32-megabyte hard disk, 8" drives, 768K RAM, and all the other features the new technology offers. The fact is, though, that for much of my work I still prefer the compact '89 with its 782K floppy drives and high speed. But why should I do without graphics?

SigmaSoft's board gives you superb graphics. With the standard RAM, you get 640 x 250 pixel resolution, a little better than the '100. No color, just very crisp monochrome. Each pixel is addressable, but we'll discuss the software that does that later.

You've heard of interlaced video, I'm sure. But if you're like me, you have never been sure exactly what it means. That is in part because the term is used ambiguously.

The IGC has two interlace modes. In the simpler form, the image on the screen continually shifts back and forth vertically by a distance of a half a pixel—giving you a much denser display. The more sophisticated form of interlace not only does this shift, but also causes the video controller to alternately use two different segments of video memory for display purposes. You can have two quite different sets of pixels displayed. The end result is a doubling of vertical resolution, from 250 to 500 lines in our case.

To take advantage of this capability, your terminal hardware must be able to display in interlaced mode. The stock '89 has the hardware; to display interlaced video, all it needs is the firmware, a ROM chip containing suitable program code.

Ingenious aftermarket suppliers have solved the problem. You can get interlace-mode support from GraphNet Systems' Super19 ROM, or from Software Wizardry's Ultra ROM. The IGC needs such support to handle interlace; both these ROMs are compatible with the IGC. Photographs of the interlaced picture (assuming appropriate exposure times) exhibit remarkable resolution.

As a bonus, the IGC board also supports the alternate character sets these two ROMs allow. SigmaSoft offers one character ROM that has script characters as the alternate set.

(To aid in hardware/software debugging, the Super19 ROM has a nice "transparent mode" to display a file's control characters, rather than let the terminal go berserk trying. Bob Willink of Dallas, the author of SigmaSoft's ROM, has made a more specialized character set for me. This set includes special characters for the control characters.)

SigmaSoft plans to release another ROM that can be used with interlaced video mode. It will feature only one character set, but those characters will be better formed, since they will have double the normal resolution.

Installing a new terminal ROM for interlaced video capability is not the final word for ultra-high resolution using IGC. The cathode-ray tube (CRT) in your Heath/Zenith computer has a very fast phosphor decay. That means a pixel quickly goes dark when it's turned off. Very quickly. In fact, so quickly that the screen will flicker when you use interlace mode, since the dots are refreshed only thirty times per second. Some people don't mind the flicker, but most do.

How do we resolve that problem? First, don't use interlaced mode. Second, a lower intensity on the screen can alleviate some of the problem.

The only right way to do it, though, is to replace your quick-phosphor CRT with one like the Langley-St. Clair that has a slower decay rate. For around $100, you can have an amber medium-decay CRT (or a green slow-decay one) that gives your '89 a whole new personality. It may not eliminate the flicker entirely, but it's a big improvement.

Remember, though, a new CRT is not a necessary upgrade; it just makes things even better.

Use any language

Using IG: graphics is like falling off a log. You use ASCII control strings; the device drivers handle translation into the machine-language code the graphics board expects. This means you can write in any language that can write an ASCII file or print to the screen. I've experimented with Benton Harbor BASIC, Microsoft BASIC, PIE, and PIP on the HDOS side; and MBASIC, Turbo Pascal, COBOL, and PL/I-80 on the CP/M side. All work equally well.

You can choose the language appropriate to your application, and use the very same graphics commands in all languages. This is a plus over the "new" Z100 and Z150 series that force you to use Z-BASIC or BASICA for graphics.

Some of the advantages

By providing the IGC's software inter-

face in his device driver, Clay Montgomery has made life a lot easier for programmers. A common alternative is to provide a software interface in a library of compiled subroutines. An interpreted application (such as one in BASIC) must usually CALL the subroutines. This requires you to pre-load the subroutines in a protected area of memory, prepare appropriate lists of control information, and use some form of CALL statement.

If you use a compiled language like PL/I or FORTRAN, you must INCLUDE these subroutines in the LINK step. A copy of the subroutines becomes part of your object module (.COM or .ABS file)—causing it to be significantly larger than it otherwise would be.

If the interface routines need to be updated (to fix bugs, provide performance improvements, or enhance capabilities), compiled programs must be re-LINKed to INCLUDE the new subroutines. That is a lot of work—and is impossible if you purchased your application program from a third party. So there are a number of advantages to the IGC's graphics interface:

No special steps are required when you compile and link your programs.

The graphics code causes no disproportionate increase in the size of your programs. (However, available memory may be decreased due to the resident device driver.)

Universal language compatibility: any program that can write to the screen or a text file can incorporate IGC graphics code.

Straightforward text commands mean even PIP can put graphics on the screen. Just send the file to PUN: under CP/M, or to IG: under HDOS.

All graphics functions are supported (including screen dumps) without sophisticated user programming.

If SigmaSoft upgrades the software support, you will be able to run your old programs under the newer version. If new commands are added, your old programs still run perfectly all right without them. If the execution of old commands is speeded up, that's taken care of in the driver; your programs just run faster. In any event, there's no need for recompiling user programs.

Simple graphics commands shorten the learning curve for the new user.

The IG: and IGC: modules install themselves dynamically, placing themselves in memory appropriately for the size of your RAM. You don't have to change your operating system disks, and modules are transportable to other users with the same board.

Flexible graphics commands

The list of commands accompanying this article shows the vast flexibility of IG:'s graphics commands. The whole scope is covered, from simple lines and circles to complex arcs (using degrees, not complicated radians) and a multitude of elegant "paint" patterns.

Also, IG: is written to minimize the number of commands and characters required to get your job done. For instance, a single CIRCLE command can draw numerous concentric circles of differing radii, and there are "shorthand" methods of re-using pixel addresses.

A flexible architecture

The architecture of the IGC is such that the graphics are on a separate memory plane from the character video, and the graphics plane does not "scroll" with the text plane. So you have independent control of text and graphics. If the clear-screen command (ESC E) is printed to the terminal, only the character data is cleared; the graphics stay.

IG: also allows you to choose either or both planes for display. In fact, you can select one of up to three "graphics pages," each of which is addressable. You can draw on one page while displaying another, allowing for very smooth animation sequences.

You'll find commands similar to Z-BASIC's GET and PUT to move graphic objects around on the screen.

Lines are always drawn on the screen from left to right, a minor irritation in some cases.

It's a snap for your programs to manipulate individual pixels using your language's AND, OR, XOR, etc., logical operators. (Compare two pictures, say, and display only the differences.)

With IGC, you can address pixels both by their absolute positions and relative to your last position, to provide the most flexible graphics available. There's even a SCALE command that makes enlargements simple.

A bonus of the IG: driver (in either operating system) is that you have a choice of access modes: you can write to it as a file (IG: in HDOS, and PUN: in CP/M), or merely prefix a screen print line with 01 hexadecimal (CTRL-A, CHR$(01) in BASIC).

You can also have your program save its output to a file rather than sending it to the IGC. This means that your elegant graphics program (which takes two hours to do its calculations) can make a text file that can be displayed in graphics in seconds. Just copy the file to IG: at any time you want.

The IGC's design also makes for simple debugging. I just prefix all graphics PRINT lines with a variable named G$. To debug, I set it to CHR$(00), the null character. In that case, the text graphics commands are displayed on my screen. Merely by changing G$ to CHR$(01), the same commands are interpreted by IG: as pixel commands.

I'd like to see an extension to that for controlling the printer!

SigmaSoft calls it Interactive, and that it is. You get a graphics cursor built-in,

with commands to place it. The GET and PUT commands allow you to move blocks of pixels.

Finally, you get an interactive device port (parallel) with commands in the IG: device driver to use it. You can choose a joystick or trackball. With a small amount of "guts level" programming, you can even be on your way to writing your own computer-aided design (CAD) package using a mouse or digitizer.

So what's the value of all these graphics?

Write your own game programs in hires. How about a full-screen pixel-graphics editor, including trackball or mouse? Design a plotter interface that allows you to preview the plot before committing it to paper. Include graphics lines, shadings, and other features for your business-application data-entry panels. Create superb business graphics on screen or on paper using standard language interfaces. (One thing I'd like to see someone write is a program to convert Z-BASIC source code.)

Room for improvement?

Is IGC perfect? Not really. I had to give up my old Super19 escape sequence to change character fonts. True, IG: has a command to switch. But I'd like to have the old terminal escape sequence, too; it's easier when you can just embed a control sequence in a WordStar file.

When my '90 had an unrelated power-supply problem, it was a real pain to work around all the extra circuit boards. I'd like to see some minor engineering changes on the mounting brackets for just a little bit more clearance.

In addition, my service technician complained there was no easy way to electronically isolate the IGC board from the system for diagnostic purposes.

Though it's not SigmaSoft's fault, my white phosphor screen has too fast a decay to be usable in interlaced mode, and I really *dislike* amber phosphors. The standard green phosphor used in Zenith units has a slower decay, but a very noticeable flicker is still present in interlaced mode. I've seen the medium-decay Langley-St. Clair amber CRT, and it still exhibits a disagreeable flicker. Perhaps the slow-decay green is better. I'm game for an external 15″ or 19″ high-persistence monochrome monitor that can really show the graphics off.

Clay's software is a marvelous invention. My complaints revolve around his refusal from the start to make it emulate the '100's Z-BASIC graphics command structure—or to use Digital Research's Graphics Systems Extension (GSX) for CP/M. Sure, some of his options, such as the command for concentric circles, are time-savers. But why isolate yourself in your own language world?

I'd rather lose some performance and gain compatibility with Z-BASIC or CB-80 programs already on the market. The

most irritating omission is the ability to specify aspect ratios for circles and arcs. (You can work around that, though, using Scale commands.)

Documentation, etc.

The manual is excellent. You get a feature summary, complete installation and configuration instructions, detailed software descriptions for the IG: and PD: drivers, an advanced programmer's guide to the hardware, a troubleshooting guide, the warranty, and the parts list. Many BASIC program examples are included, which should make transition to IGC look like child's play.

There's little you won't know, or at least be able to look up. My only wish is for a couple of summary pages. It would be nice to have a command summary (sort of like the one I made for this article). And it would be nice to have a pattern page that identified each paint pattern, line style, and 'clear style' by name and number. (You can get dashed lines, as well as light and heavy densities of dots. And when you clear the screen, you can get the screen striped, white, or gray, as well as the customary black.)

SigmaSoft's warranty is of the standard 90-day variety. It's written in plain English, though—unusual these high-tech days. SigmaSoft forewarns you that most problems are either configuration or software problems. I have installed two boards now, and had one bad cable, which was promptly replaced. The standard software update fee is $10.

Simplicity helps

The most striking feature of the IGC is its versatility. Originally intended to put pixel graphics on your '89, Clay's functional design provides for a very flexible hardware peripheral.

Because the IGC uses simple, fast circuits, no hardware handshakes are required. The IGC can take anything a 4-MHz CPU can throw at it. That makes for fast, simple software interfaces.

Because the board is accessed through a standard parallel interface, the on-board RAM is addressable without complicated bank-select algorithms. True, that RAM can't be used directly by the CPU. But most programmers understand port I/O better than bank-select techniques, anyway.

And look at the possibilities SigmaSoft is already supporting with supplied software.

First, the board's graphics are available through IG: and IGC: device drivers. The general ASCII sequential format of the data required to drive IG: allows you to write software in any language that can write an ASCII file or print to the screen.

Second, the die-hard can still choose to address the IGC board directly through port I/O for the ultimate in graphics speed. The documentation pro-

vides you with the necessary control codes.

Third, a sophisticated RAM disk is easily implemented in either operating system through those same port I/O commands.

Fourth, excellent screen-dump utilities (in full graphics mode) provide a way to make a hard copy of your graphics development.

Fifth, system productivity can be increased by using the included RAM spooler software; it lets you output print files at CPU speed, and the printer catches up while you continue your work. (I've seen hardware versions of a 64K buffer alone costing as much as $350!)

The future?

There are other possibilities. SigmaSoft is working on an alternate RAM disk driver that provides compatibility between HDOS and CP/M. Place the file to be transferred in the RAM disk, boot the other operating system, and copy the file back down.

Also in the works is a high-res graphics editor *à la* DR Graph, using the trackball interface. Clay displayed his prototype at a recent local Heath Users' Group meeting.

I've a few ideas for using IGC, too. For instance, my disk-intensive word processor races along at RAM speeds if the document file is on drive M:. If you have column-dependent data to enter, set up the form in graphics RAM, safe from normal clear-screen calls. I use it to edit COBOL source code with PIE.

How do I rate it?

SigmaSoft's Interactive Graphics Controller provides a cost-effective alternative to trading in a perfectly good H/Z90 (or '89, or H8 with a '19 terminal) for one of the more sophisticated graphics machines.

As a bonus, you get a remarkable peripheral RAM device, addressable through normal parallel port I/O. Two parallel ports save your printer dollars; parallel printers *cost less!* The RAM-spooler software increases system productivity and availability. Add in a sprinkling of useful software, support for popular graphics printers, dual character set support, trackball and joystick support, and the ability to expand to 256K RAM when the price is right.

There's no question this peripheral beats all comers in the graphics world, and makes itself useful on its off-hours.

If it appears that I am not objective, sue me! I've used IGC for several months now, and would be lost without it. I must admit I'm prejudiced, both for the '89 and the IGC.

In my book, it rates *five stars*. How about five concentric circles, with "tiretread" fill? Fifty bucks to the first guy who implements Microsoft's Flight Simulator on it! (Provided I get a copy!)

Ordering Information

Interactive Graphics Controller: 64K model, $495; 128K model, $520; 256K model, $270; manual only, $10. Include $5 for U.P.S. shipping; Texas residents add 6% sales tax. Specify H/Z89 or H8.
SigmaSoft and Systems
4488 Spring Valley, Suite 107
Dallas, TX 75234
214/392-1025

CRT replacements, $99 + $7 shipping.
Langley-St. Clair Instrumentation Systems, Inc.
132 West 24th Street
New York, NY 10011
800/221-7070, 212/989-6876

Super19 ROM, $49.95.
GraphNet Systems, Inc.
Country Lights Villas #1121
Bensalem, PA 19020
215/752-4604 or 215/376-5043 evenings

SZAP (Super Zap), $24.95.
The Software Toolworks
15233 Ventura Boulevard, Suite 1118
Sherman Oaks, CA 91403
818/986-4885

Ultra ROM, $49.95.
Software Wizardry
1106 First Capitol Drive
St. Charles, MO 63301
800/862-8948 (orders), 314/946-1968 △

Z100 Notebook

Alison Phillips

Hobbyists and books

One of the nice things about enjoying computers as a hobby, as opposed to using computers to make a living, is that you can pursue any area of interest you desire at any pace you desire. Also, you do not have to justify your expenses any more that a golfer justifies a ball in the water hazard. Playing with computers is a great way of disposing of discretionary income, and can be a source of personal satisfaction.

Hobbies, good books, and friends all go together. I must confess that love of books is one of my weaknesses. I buy books the way some people go out to dinner—for 15 or 20 dollars, I can get several evenings of good entertainment. And the indigestion is about the same.

For instance, take my interest in the Microsoft Disk Operating System (MS-DOS). As though the combined 1,500 pages in the two Zenith Data Systems MS-DOS manuals (User's Manual and Programmer's Manual) were not enough, I have purchased and read the *MS-DOS User's Guide* by Chris DeVoney, and the *MS-DOS and PC-DOS User's Guide* by Peter Norton. DeVoney's book is published by Que, Inc., and Norton's book by Brady Communications.

It is not my intent to review these books here. (*Sextant* excerpted a chapter from Norton's book in the May-June 1984 issue, and I commented on DeVoney's book in my March-April 1985 column.) But I would like to pass on my impressions of the two books—one compared with the other. Right from the top, I consider DeVoney's book much the better buy. It costs less ($12.95 vs. $15.95) and provides more and better coverage.

DeVoney's book is for the serious user and contains "beef"; Norton's book is interesting, generally informative, and entertaining—suitable for a beginner, or a user who wants some easy reading and does not need to know the full potential of MS-DOS.

Now that I have read both of these books, most of the time I prefer to go to Zenith's MS-DOS manual for my initial reference.

CP/M NSWEEP utility

CP/M users who have not used NSWEEP have a delight ahead. It is a file-maintenance utility which is so user friendly that no documentation is needed, and it is powerful. Packing so much power into just 12 kilobytes has to require some tight coding. Dave Rand, the author, is to be congratulated and thanked for this fine utility.

I have never used DISK or WASH, but I am told that NSWEEP improves upon them. In addition to the customary file-maintenance actions—such as print, rename, copy, and delete—NSWEEP can squeeze and unsqueeze files as they are copied. Also, if you have a large directory, the fast FIND function will direct you to a particular file in an instant.

I have never found a great need for utilities which do the same thing that the operating system does with its resident commands. But NSWEEP's ease of use is certainly an advantage, as is the fact that it gives file sizes and disk space, and adds the file sizes as files are tagged for action.

It is convenient to have the squeeze and unsqueeze power at hand. The best application of NSWEEP that I know—and I just used it for that purpose—is to build a new disk of selected files from an old disk which has a very large directory of diverse file names.

My copy of NSWEEP was passed to me by a friend. To date, I have been unable to locate its source. If some good reader knows where it can be downloaded or purchased, please let me know via *Sextant*.

SuperCalc Summary Guide

The *SuperCalc Summary Guide* is a 59-page booklet written by Arthur C. Chuck and published by Linnart Publishing. This booklet, true to its title, explains SuperCalc syntax and commands and provides practical examples. In addition, it contains a section of formulas commonly used in the business and financial world. And it shows how they may be entered in SuperCalc's blocks.

It is an easy-to-read book which can be perused in an hour; but I suspect that the reader should spend some time beforehand with SuperCalc's User's Guide and Reference Manual before turning to the *Summary Guide*. The *Guide* is best used as a quick reference, kept close to the computer and used as a memory aid.

The *Guide*'s coverage is remarkably complete and it has a good index. It is explicit, and should it have errors, only an expert could ferret them out. I consider this little booklet worth the modest price of $3 that I paid for my copy at the Heath store.

SuperCalc and PeachCalc

A lot of us have used Sorcim's SuperCalc under CP/M on our H8s and H89s

and have now moved up to PeachCalc under MS-DOS or the Zenith Disk Operating System (Z-DOS). Can SuperCalc files saved on CP/M-80 disks be transported to Z-DOS/MS-DOS (DOS) disks and used as though they had been developed by PeachCalc?

I was curious to find out. So, using RDCPM.COM, I transferred a SuperCalc file over to an MS-DOS disk. Next, I executed PeachCalc, and from PeachCalc I loaded the SuperCalc file with no problem. As a further test, I modified the file and saved it. It is now a PeachCalc file, just as though it had been developed with PeachCalc in the first place.

The beauty of it all is that for all intents and purposes SuperCalc and PeachCalc are the same. No new commands need be learned, and no work need be redone to use the old files.

It has been some time since I worked with SuperCalc, but it seems to me that PeachCalc runs faster. The cursor zips from block to block so fast that it takes a little finesse to keep from overshooting. After all, the increased speed is to be expected from the 5-megahertz central-processor unit (CPU) used in the Z100; I was working at 2 MHz with SuperCalc on the H89.

There is CHKDSK, and then there is CHKDSK

The CHKDSK program is a transient file furnished with both the Z-DOS and the MS-DOS operating systems. It is used to examine and analyze the directory and File Allocation Tables (FAT) of the disk and to display information about the disk and memory system. It will also display directory information on hidden files and is a convenient way to determine if a disk is bootable. With MS-DOS version 2, CHKDSK has an /F switch which optionally corrects some problems that crop up in the directory structure.

Here is a word of *caution* that could save you a headache.

The CHKDSK.COM utility furnished with Z-DOS 1.25 is 1,754 bytes long and is to be used only with Z-DOS. The CHKDSK.COM utility furnished with MS-DOS 2.0 has a size of 6,468 bytes and is to be used only with MS-DOS. The hierarchical file structure of MS-DOS requires the expanded capabilities of the larger CHKDSK utility.

Since one of the functions of CHKDSK is to correct common disk directory problems, using CHKDSK on other than its parent system can result in scrambling or erasure of the directory.

PeachText will edit WordStar files

PeachText will edit WordStar files, but if you haven't tried it, you may be in for a surprise or two.

When PeachText loads a WordStar file, the prompt will show that the file contains control characters. The loaded file will show a tilde (~) at the end of each line, instead of at the end of each paragraph, as with PeachText.

That tilde looks just like the curvy character on the same key with the backward apostrophe. You will be disappointed, however, if you confuse the two when you try to delete those unwanted line endings. Yes, you can command PeachText to search for each ordinary tilde and replace it with nothing. But all you'll delete are any ordinary tildes.

The line-ending tilde is just the screen representation for a carriage-return/line-feed pair. Both of these are control characters, and PeachText's search-and-replace function applies mainly to non-control characters.

That had me stuck for a while. Without some way to globally delete the tildes, it is quite tedious to convert a WordStar file to PeachText format. Each line ending would have to be deleted individually. This can be done by placing the cursor over the tilde and pressing the F9 (delete line) key twice in succession.

Fortunately, my manual reading finally produced the answer. In a search-and-replace command, simply use a tab instead of a tilde. A tilde will be displayed and PeachText will search for the line-ending tildes and delete them. In all respects, the WordStar file then becomes a PeachText file and may be formatted with PeachText's embedded formatting commands.

But there are apparently only four such characters that PeachText can search for (the tilde, the page feed, the line feed, and the block marker). I still haven't found a way to treat other control characters globally.

Remember that PeachText has its modes

I bring up the subject of PeachText modes because of a long-distance call I just received from my son. He was disturbed because something was wrong;

the tilde would no longer display at the end of the paragraph in the usual manner. He was preparing a manuscript and could not account for the strange behavior of his computer.

After considerable telephone exchange, it became evident that he had inadvertently used a file extension reserved for programs.

The PeachText edit command automatically sets the Program Mode when the user edits a file with any of these file extensions: ASM, MAC, COB, FOR, BAS, and PRN. In the Program Mode, the display of the carriage return is inactive. To correct the problem, he renamed his text file with a TXT extension; the tilde was again displayed at the end of paragraphs in PeachText's customary fashion.

Fast Reference Guide to SuperCalc

The Fast Reference Guide to SuperCalc is a 28-page booklet written by Robert C. Baker and published by the Hayden Book Company. I bought it for $3.95 at the Virginia Beach Heath/Zenith Computers & Electronics store.

This booklet presents in an orderly manner nearly every SuperCalc or PeachCalc command and function; then it provides explicit examples. It has no index because it really does not need one. The book is carefully and professionally done. It uses shading effectively to distinguish between subject and text; this makes the booklet easy to follow and pleasant to the eye.

Let not the diminutive size belie the depth and breadth of its content. It is so complete and has such depth that it will keep you away from the reference manuals except as last resort. Here is an example of one of the more complex formulas explained.

IF(E8+9>=H4,B3,IF(OR(C2*.4<5,C3*.1>8),B4*100,B3*.01))

Translated to English, that means: If the value in cell E8 plus 9 is greater than or equal to the value in cell H4, then use B3 for the value in the current cell; else if the value in cell C2 multiplied by .4 is less than 5 or the value in cell C3 multiplied by .1 is greater than 8, then use the value in cell B4 * 100 for the current cell; else use the value in cell B3 multiplied by .01 for the current cell.

Something like this example might be used when a sales commission varied significantly on the basis of the size of the sale (E8, say) together with a number of other factors. Admittedly, this is a contrived example; it serves, though, to demonstrate the syntax for nested IF statements. These can be of value when two conditions must be met.

This example also shows the outlandish difficulty of SuperCalc syntax and points to the need of having a good reference at hand. Any user of SuperCalc or PeachCalc should find the *Fast Reference Guide* a valuable little book.

CP/M and Z-DOS resident commands

Resident commands are one indicator of the power of an operating system. They are the system commands that are integral to the operating system itself. They don't require any files on disk except those you need in order to boot up. When you do, they are loaded into memory and are available for execution without disk access. Transient commands are ones like CONFIGUR or DEBUG which require their own disk file.

CP/M-80 and CP/M-85 have six resident commands that can be remembered easily by the acronym DUSTER for DIR, USER, SAVE, TYPE, ERA, and REN.

How many resident commands does Z-DOS have? It appears that Zenith wanted to keep this a secret, for the term "resident" does not appear anywhere you would normally look for it in the Z-DOS manual's index or in the Z100 User's Manual index. For that matter, it is also omitted from Appendix A of the User's Manual, which contains the glossary of commonly used terms. (If you want to find "resident" in the Z-DOS index, look under "System.")

If you page through the User's Manual, you will come across a listing of "Internal Commands." These are the same thing as resident commands. (And "external" commands are the same as transient commands; the entries in the index are under "Commands.") Z-DOS does not include CP/M's useful USER and SAVE commands. But it does have five additional commands: TIME, DATE, COPY, PAUSE, and REM.

These additional commands were a small step forward, but did not do much for mankind; to get the full benefit of the power of resident commands, you must move up to MS-DOS version 2.

MS-DOS transient and resident commands

I have always enjoyed both learning and teaching. And one of the things I learned early is: "If you are able to quantify and define a subject, then the learning process becomes easier." Bearing this in mind, let us take a quick overview of the MS-DOS system commands so that we may focus on three of the commands in the section which follows.

The MS-DOS version 2 distribution disks include 29 transient programs. The PATH command can be used to find and execute these transient programs. (The PATH command will not work with text or data files.)

Each time a transient program is executed, it must be loaded from the disk into memory. Twenty of these transient programs bear the COM file-name extension; the remainder, the EXE file-name extension.

Volume 1 of the MS-DOS manual has a splendid index which includes multi-

ple references to the resident commands. It turns out that there are 27 MS-DOS resident commands, and each is indexed and carefully documented. The additional resident commands are convenient to use and they perform useful operations such as clearing the screen and displaying the volume number.

Also, there are rudimentary resident programming operators such as IF and GOTO to aid in batch processing. Four of the MS-DOS resident commands aid in managing the hierarchical directories. (CHDIR displays or changes the current directory; MKDIR makes a new directory; RMDIR removes a directory; and PATH specifies directories to be searched for transient programs.) As an MS-DOS owner, I am pleased with the quality of the technical manual and the additional power of the operating system.

Of the 27 resident commands, eight are especially suited for batch processing. I have devised a nonsense acronym to help me remember these eight batch operators. It is PRESSFIG, which stands for: PAUSE, REM, ECHO, SET, SHIFT, FOR, IF, and GOTO.

An interesting thing to note about batch commands is that they do not have to be used in a batch file. Indeed, they may be entered directly from the command line. In the section which follows, we will employ the FOR, IF, and COPY resident commands directly from the command line to make short work of what might well be a tedious task.

Using MS-DOS batch commands from the command line

MS-DOS has a rudimentary command language which allows logical and conditional statements to be made from the system command prompt. I can best illustrate this by example. Suppose you have two data file disks, each with a large number of files. Disk One is the master, and Disk Two is a backup. For some reason or other (it always seems to happen), the two disks have slightly different directories. How do you get the two directories in agreement?

You could first list the directory of Disk One, and then the directory of Disk Two, and try to visually determine the whereabouts of any dissimilar files. Have you ever tried that with large directories?

Or you could copy Disk One to Disk Two with the *.* wildcard specification. Then reversing the procedure, you could copy Disk Two to Disk One. But this is a tedious brute-force procedure not in keeping with the artful use of the MS-DOS commands at our disposal.

Here is a better way to accomplish our stated purpose. With Disk One in the A drive and Disk Two in drive B, log onto the A drive and issue the following command:

```
FOR %A IN (*.*) DO IF NOT EXIST B:%A
 COPY %A B:
```

After the command is executed, swap disks between drives and strike the F3 and RETURN keys.

Here is what happens: (1) Those files on Disk One which are not already on Disk Two are copied to Disk Two. (2) After the disks are swapped, the command is re-executed by striking the F3 and the RETURN keys. The use of the F3 key copies the command-line buffer to the screen and saves retyping the command line. This time, those files on Disk Two which are not already on Disk One are copied to Disk One.

In plain English, the command we

used says: "Make a loop, and upon each iteration of the loop, assign the next file name that appears in the directory of the disk in drive A to the dummy variable named %A. Then check to see if the file name in the variable %A appears in the directory of the disk in drive B; if it does not, then copy this file from drive A to drive B."

Neither CP/M nor Z-DOS has the resident commands or the power to selectively copy files as in the example above. I hope you like this example of what can be done from the MS-DOS command line. How about sending me one of your creations?

Fed up with packaged compromises?

I don't know about you, but I've about had it with multipurpose software. Rarely does a multipurpose tool do a specific job as well as a tool designed specifically for the intended purpose.

I don't like the packaging of PeachText 5000, with the exception of the thesaurus, which serves nicely at the beck and call of the PeachText editor. I don't like the two miserable little manuals that are skimpy in coverage and which have everything jumbled together, including the index.

I already have a bias which I'm afraid will carry over into Symphony and Framework as well, if I can believe the reviews I have read. In my opinion, multiple tools are not for serious artisans. What good mechanic wants a combination screwdriver, pliers, and hammer?

Bundling programs into one big, expensive package denies users the option of selecting only the one best program available for a particular job. Not only that, but it sometimes compromises the usefulness of the individual programs. And it is likely to degrade the documentation.

Let's talk specifics. Magic Wand was not a bad first-generation word processor. It stood as two independent programs, Edit and Print. The user had direct access to each program through the CP/M command line and each program did its job well. The technical manual was a cohesive document, sturdy in structure and easy to use. (But forget about the index—which was woefully inadequate.)

Then came along the PeachText 5000 package deal. They wrapped up Magic Wand under a menu, in a shell that isolated the user from the operating system, and made it tedious to work with. They took the stand-alone Magic Wand technical manual, reduced the print size, and then added to the insult by printing displays in green so that the bespectacled would have to hunker down and squint.

As though that were not enough, they incorporated the text into two little books along with the documentation of four other programs. Then as a crowning touch, they interspersed the already miserable Magic Wand index with the indexes of the other four programs.

That's progress? In spite of all of that, here I am using PeachText with gusto and enjoying all of my growsing.

In contrast to the packaging approach, there are stand-alone programs like MicroPro's WordStar and Microsoft's Word. Each of these programs is dedicated and each has independent documentation support. Yesterday, I spent some time at the Heath store trying out Word, like a lady trying on a new hat. Window shopping is fun, and I liked what I saw.

If first impressions are lasting, and since Word now runs on the Z100, then Zenith has a potential customer. I was favorably impressed with the appearance of the technical manual, and what appeared to be complete and detailed coverage of Word and word processing in general. The Microsoft Word manual is published to the same exacting standards that Zenith used with the MS-DOS manual; and it contains a very useful glossary of word processing terms and a comprehensive index.

MS-DOS Programmer's Utility Pack

Yesterday I purchased from the Heath store the MS-DOS Version 2 Programmer's Utility Pack for myself, and an adjustable secretary's chair for my wife. You know how these things work.

The utility pack bears Heath part no. CB-5063-16, and lists for $149 in the Spring '85 Heathkit catalogue. When I bought MS-DOS 2, though, Zenith offered a discount on the programmer's pack. I used the coupon I received in the mail and took advantage of the special price of $74.50.

The package provides detailed support for tailoring the MS-DOS system to meet specific needs and furnishes guidance for writing programs to take full advantage of MS-DOS power. It will be some while before I can utilize these features, or for that matter assimilate the overwhelming amount of information provided.

The pack consists of four 360K disks chock full of files and a thick Programmer's Manual, similar in appearance to the manual for MS-DOS version 2. The manual has a body of about 700 pages, an appendix of about 53 pages (including a glossary of new terms), and a comprehensive index of 29 pages.

Three of the disks contain mostly ASM files of the source code for MS-DOS's basic input/output system (BIOS) for the Z100, and ASM source for the Z150 BIOS. The fourth disk contains 36 utility programs and supporting files.

The Programmer's Manual has 12 chapters. The first five chapters provide thorough coverage of the generic MS-DOS system. The next three chapters explain the MS-DOS implementation on Zenith computers. Then there are chapters on the full-screen editor, the macro assembler, and the cross-reference utility. The final chapter in the manual deals with each of the utilities furnished on the utility disk. All in all, the Programmer's Manual is a source of essential and otherwise difficult-to-obtain information and on its face shows quality.

The BSE full-screen editor

The feature utility in the Programmer's Utility Pack has to be the Basic Screen Editor (BSE). I have already heard raves from my friends who have

used this editor and I am yearning to get with it. But to master any new powerful program usually takes a powerful amount of work.

The essential documentation for the editor is 64 pages long. Versions of the editor are on disk for both the Z100 and the Z150. The speed of the screen and the text handling ability of BSE is amazing. This is accomplished, in part, by a feature called the "prioritized display manager," which prints only the final display resulting from a rapid series of commands.

In addition to the customary word-processing features, BSE can maintain up to 255 buffers active at a given time. The buffers enable you to edit more than one file during a single editing session and/or access different locations in a file in a single session.

BSE allows you to batch commands together in a sequential string of commands and store them in a macro register. These macros may be used later in the editing session or stored on disk for future sessions.

The editor also maintains a deletion salvage stack of 128 lines in "last in first out" (LIFO) order. This will allow the retrieval of deleted lines or portions thereof. Adequate on-line help is provided and BSE can read and edit text files created by other editors and word processors, such as WordStar.

One final qualification. BSE is a programmer's editor and does a good job for a programmer, but it does not support advanced formatting features. It is not a substitute for WordStar or PeachText 5000.

Sources mentioned

Brady Communications, Inc.
Divison of Prentice-Hall
Bowie, MD 20715
(Peter Norton's *MS-DOS and PC-DOS User's Guide*)

Linnart Publishing
34 West Wainwright Drive
Poquoson, VA 23662
(*Fast Reference Guide to SuperCalc*)

Peachtree Software, Inc.
3445 Peachtree Road, N.E.
Atlanta, GA 30326
800/554-8900

Que Corporation
Suite 202
7999 Knue Road
Indianapolis, IN 46250
(Chris DeVoney's *MS-DOS User's Guide*)

REMark
Heath/Zenith Users' Group
Hilltop Road
Saint Joseph, MI 49085
616/982-3463 △

Menu Control with HDOS MBASIC

Run an entire HDOS MBASIC session, from boot to bye, from a menu.

Rick Streeter

Back in 1979 when I bought my trusty '89, Heath was just starting to hyphenate with the big Z. And what I knew about computers could be put into a very small hand, but I had the bug and I bit. My wife, who sometimes feels like a computer widow, still says things like "But what can it do?" or "You spent aaahlll that time and that's all you got?"

Well, to justify the expenditure, I planned to write some business software and some games for the family. To start with, however, I bought most of my software. One thing bothered me, though: a good portion of this software seemed to be written for use only by programmers. Who else would put up with obscure system messages?

Most programs were supplied with small but noxious bugs which would bite at the most inopportune time. Games had the most. Yes, even those from the Heath Users' Group. For example, DND didn't link to LAIR.BAS. (You mean no one had won it yet and complained about not getting the gratification of the fancy end picture?)

Some games seemed to be superficially screened but apparently were not checked for playability. Many would give me an error such as "Redo from start," or my personal favorite "Unprintable error," at the least provocation. (Was my error so bad that it couldn't even be printed?)

Many bombed with little difficulty. And more left my '89 in the most confused state of mind with some of the special terminal features set but not cleared. Have you ever tried to read a Microsoft BASIC error message in graphics?

Looking for a good MENU

I decided that something had to be done about this. In self defense, I learned MBASIC in order to use these programs myself. But my kids wanted to use the computer, too. (Translation: play games on it.) How could they do this with all those little beasties in the programs ready to bite at any moment? How could they deal with "Disk I/O error"?

I rewrote all the offending MBASIC games to try to make them more "user friendly" (overworked term). I spent many a happy hour in front of my '89 "breaking," "bombing," and fixing programs. I used some of my own ideas and some of those presented by Roy Reichert in issue #15 of the Heath Users' Group magazine, *REMark*. ("Some Thoughts on Writing Game Programs," March 1981.) Most problems seem to be with input to the programs. They often get confused when they expect one kind of data and get another because input has not been preprocessed.

All this resulted in much more easily run games. But if my kids wanted to play them, I still had to take care of some basic housekeeping expected by the Heath Disk Operating System (HDOS). I had to BOOT, LOAD the device drivers, run MBASIC, LOAD the game, and RUN it. They had to remember SYSTEM and BYE—or call me when they wanted to quit.

RESET and QUIT are included among the choices which can be selected by the MENU.

Clearly, some sort of link was necessary between the programs. I had heard about menus but I really thought they were used only in restaurants. Anyway, when I looked into them further, it seemed foolish to order-by-number, so to speak.

Enter *REMark* #26 and "The MENU Program Revisited," by Eric Pang. He was using menus without all that pick-a-number fuss. He also ran MBASIC programs and linked back to the menu by a RUN"MENU" instead of END in each program. And he was linking to and running .ABS programs, as well! Coming out of the .ABS program, you still had to reload MBASIC and RUN the MENU program; but his ideas still held some possibilities.

The following programs are in part the result of his and many others' ideas. Together, they make a totally (well, almost) idiot-proof menu which links to any MBASIC or .ABS program and then back to the MBASIC MENU. The programs are START.ASM (Listing 1), MBPROL.ASM (Listing 2), and MENU.BAS (Listing 3).

My configuration

First, some background:

I am running my '89 at four megahertz, modified according to Patrick Swayne's articles in *REMark* #34 and #38 (November 1982, "A Programmable 4-MHz Modification for the H89," and March 1983, "4-MHz Update"). My '89 has 64 kilobytes of random-access memory (RAM). And I use four drives: two double-sided 80-track, and two single-sided 40-track.

Also, I use a fully HDOS-compatible operating system, OMDOS, from Skip Chambers of Carrollton, Texas. It addresses 64K RAM, and on boot-up, it copies the HDOS read-only memories (ROMs) into RAM. As well, it makes both HDOS overlays permanently resident. This allows more error-free operation at 4 MHz. (The HDOS ROMs might be too slow.) And OMDOS uses less total memory than regular HDOS.

My disk drives are driven with the HUG hard-sector SY: driver—modified by Mr. Chambers to work at both 2 and 4 MHz. A switchable SY: driver is necessary under OMDOS since CPU speeds can be switched under an OMDOS system call (SCALL). This would confuse hard-sector drives like mine. (This is not supposed to be a problem with soft-sector drives, I have been told.)

Although this is my configuration, these programs are not dependent on any of these features.

START.ASM

The basic idea behind this set of programs is to create an environment in which nothing can take place except running the games or other programs you want to select. You will have a special boot disk with the usual HDOS file set modified to support the menu program. (As discussed below, you will

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1	2	3	4	5	6	7	8	9	10	11	12	13	
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Excellent
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Good
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Fair
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Poor
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Didn't read

Comments: _____

66a2

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4. Wayne Rash, Jr., **Weighing the Merits of the Z160**, p. 41.
5. Kenneth A. Patrick, **A Look at SigmaSoft's Interactive Graphics Controller**, p. 49.
6. Alison Phillips, **Z100 Notebook**, p. 57.
7. Rick Streeter, **Menu Control with HDOS MBASIC**, p. 65.
8. Glenn F. Roberts, Ph.D., **Tektronix Terminal Emulation for Your Z100**, p. 77.
9. Edward A. Byrnes, **BASIC Questions and Answers**, p. 91.

have to change the flags-locked (L) and write-protect (W) flags on the standard SYSCMD.SYS.) The MENU program and MBASIC will be on the boot disk; and SY1: will be the games disk.

START.ASM (Listing 1) is the assembly source code for a very rudimentary SYSCMD.SYS; it will replace SYSCMD.SYS on your boot disk; and MBPROL (Listing 2) will become PROLOGUE.SYS.

When HDOS BOOTs, it looks for a PROLOGUE.SYS file to get any preliminary instructions. (More on this later.) Then it links to SYSCMD.SYS to process input; this is known as the command mode.

My SYSCMD.SYS can do only two things. It does not accept user input; rather, it links directly to MBASIC on the boot disk. Then it calls up MENU.BAS, and sets aside space for MBASIC USR routines via MBASIC's /M: switch.

MENU.BAS will go to SY1:, the games disk, and look for a file, FILES.DAT, containing all the .BAS and .ABS programs in the directory. (If it doesn't find such a file, it creates it. And if SY1: is not mounted, MENU will mount it with a RESET.) Then it will display the menu and allow the user to select a program. When the user quits that program, the menu will be displayed again.

START can be run under either OMDOS or regular HDOS. This choice is controlled by the OMHDOS EQUate. As it's given in Listing 1, it's NO. If you have OMDOS, make that YES before assembly. At a number of places in the program, you'll see IF directives whose execution depends on which system you have.

Toward the bottom of Listing 1, you'll see a significant difference between the two systems. Note that the memory addresses available under OMDOS are 5K higher than under regular HDOS.

Regular HDOS's lower boundary is at 59984 decimal. Loading both of HDOS's overlays lowers it to 54829 decimal. I allow for a 1K device driver, 1K of MBPROL, and some slop. So when START calls up MBASIC and MENU, the arguments to the /M: switch will be 52499(53500). And we can have MBPROL originate (ORG) at 52500 decimal. 52499 defines the upper memory limit for MBASIC (the interpreter, source program, scratch space, etc.); the next address is available for USER subroutines or other uses.

53500 defines the top of reserved memory. This of necessity has to be below the bottom of HDOS. This space can be figured by using SYSCMD's STAT command after the HDOS overlays and the necessary device drivers have been loaded. Convert that value to decimal and the necessary values can be computed.

Under OMDOS, the /M: arguments will be 57499(58500) and MBPROL will ORG at 57500.

I should note here that you need

Listing 1. START.ASM is the assembly source code for a very rudimentary SYSCMD.SYS to replace your current HDOS SYSCMD.SYS. The new SYSCMD will link to MBASIC and call up MENU.BAS.

```
        TITLE   'START.ASM -- Rename to SYSCMD.SYS'

*       By:
*           R. L. Streeter
*           Route #1   Box 424
*           Bigfork,  MN  56628
*           15-Mar-85
*
*       SYSCMD.SYS  for game disks.

*       Automatically loads MBASIC and sets top of MBASIC and LWA
*            of user memory area.

YES     EQU     0
NO      EQU     1

OMDOS   EQU     NO                      NO FOR HDOS ASSEMBLY (YES for OMDOS)

.LOADD  EQU     62Q
.LOADO  EQU     10Q
.CLEAR  EQU     55Q
.LINK   EQU     40Q
.DAD    EQU     206Q
.FAST   EQU     207Q
$TYPTX  EQU     31136A
$MOVE   EQU     30252A
S.SYSM  EQU     40320A
S.RFWA  EQU     40356A
AIO.DTA EQU     41053A
DEV.RES EQU     2
DR.PR   EQU     2
OVL0    EQU     0
OVL1    EQU     1
USERFWA EQU     42200A


        ORG     USERFWA

START   EQU     *

        IF      OMDOS
        SCALL   .FAST                   SET FAST SPEED IF OMDOS
        ENDIF

        IF      1-OMDOS IF HDOS WE NEED OVERLAYS
        MVI     A,OVL0                  GET OVERLAY 0 INDEX
        SCALL   .LOADO                  LOAD IT
        JC      BYE                     QUIT IF UNABLE

        MVI     A,OVL1                  GET OVERLAY 1 INDEX
        SCALL   .LOADO                  LOAD IT
        JC      BYE                     QUIT IF UNABLE
        ENDIF

*********                       LOAD LP: DEVICE

        LXI     H,PROAA                 POINT AT LP: DESCRIPTER
        SCALL   .LOADD                  LOAD IT
        JC      CONT                    CONTINUE IF NOT THERE
        CALL    SLOAD                   ELSE - LOCK IT INTO MEMORY
        CALL    $TYPTX
        DB      'LP: Loaded.',212Q      AND TELL USER

CONT    CALL    $TYPTX
        DB      27,'E',200Q             ELSE - CLEAR SCREEN
PSTACK  LXI     H,0
        DAD     SP
        SET     PROBE-PROB+1            LENGTH OF ARGUMENT FOR MBASIC + 1
        LXI     D,-.
        DAD     D
        SPHL
        LXI     B,PROBE-PROB+1
        LXI     D,PROB
        CALL    $MOVE
        LXI     H,PROC
        SCALL   .LINK
        CALL    $TYPTX
        DB      7+200Q
BYE     MVI     A,0FFH
        SCALL   .CLEAR
        SCALL   .DAD                                              →
```

```
        CALL    $TYPTX
        DB      7,27,'E',27,'Y+0 Remove all disks and turn '
        DB      27,'p COMPUTER ',27,'q OFF.',200Q

DONE    JMP     DONE                    HANG UP MACHINE HERE
*                                         TO FORCE RESET

*********                           LOCK DEVICE DRIVER INTO MEMORY

SLOAD   LHLD    S.SYSM                  RESIDENT SYSTEM FWA
        SHLD    S.RFWA                  STORE IT AS HDOS FWA ADDRESS
        LHLD    AIO.DTA                 GET DEVICE TABLE ADDRESS
        LXI     D,DEV.RES                 OFFSET TO RESIDENCY FLAG
        DAD     D                           POINT TO ITS POSITION
        MOV     A,M                     PUT IT INTO (A)
        ORI     DR.PR                   SET PERMINENT RESIDENCY FLAG BIT
        MOV     M,A                     PUT IT BACK INTO MEMORY
        RET                             AND RETURN

*********

PROAA   DB      'LP:',0
PROB    DB      ' MENU/M:'

        IF      OMDOS
        DB      '57499(58500)',0        FOR OMDOS
        ELSE
        DB      '52499(53500)',0        FOR HDOS
        ENDIF

PROBE   EQU     *-1
PROC    DB      'SY0:MBASIC.ABS',0

        END     START
```

MBASIC 4.82 in order to specify two arguments to the /M: switch. MBASIC 4.7 allowed only one and didn't give much protection to USER routines. However, the Heath Company replaced version 4.7 with 4.82 at no charge to most registered owners.

If the .LINK SCALL cannot link to MBASIC (PROC label), START exits to a DISMOUNT of all disks (a .DAD SCALL); it enters an endless loop forcing a terminal reset before a reBOOT.

In OMDOS, device drivers don't have to be LOADed prior to linking to MBASIC if enough space was reserved for them at the .LINK SCALL to MBASIC. (I have not tried it, but I suspect that this is true for HDOS as well.) The /M: switch allows space for a 1K printer driver (LP.DVD) and 1K of slop. OMDOS also has .FAST and .SLOW SCALLs which switch speeds if the '89 has the HUG 4-MHz modification.

Most of the code of this portion of the program set is from the HDOS System Programmer's Guide—except for my BYE routine and the SLOAD from Al Heigl in *REMark* #11 (page 21, "Letters"). The EQUates and comments are mine. I have attempted to comment these programs somewhat, but my assembly-language knowledge is rather limited.

Unlocking an L flag

Assembling START shouldn't be any problem. Naming it "SYSCMD.SYS" can be. HDOS's essential files are all write protected. That's not surprising: writing over a system file could prove uncomfortable.

Ordinarily, writing over a write-protected file is fairly easy: just use the FLAGS utility to delete the W flag beforehand. The command FLAGS <FILENAME.EXT> will show you what flags are in effect and let you change them. Unfortunately for us, HDOS gives additional protection to SYSCMD.SYS by setting the flags-locked (L) flag. That means that FLAGS can't alter a file's flags, neither to add nor delete a flag.

The way to get around this is to use some sort of patching utility, one that can change *anything* on a disk. One of those utilities is PATCH, which comes with HDOS. Another is UDUMP, by Michael Cogswell, offered by HUG. (There are other, similar, patch programs offered by other suppliers.)

Of the two, UDUMP is probably the easier to work with. In fact, it lets you delete flags simply by hitting a function key. PATCH can be a bit slower; it just gives you a hexadecimal or octal dump of the disk file. Sometimes it can be slow finding your way around a file.

Patrick Swayne, however, has made life easier for us with an article and program in *REMark* #28, May 1982 ("PATCH Mysteries Revealed"). The program is specifically designed to change even L flags.

Whatever program you use, however, it is well to remember that working with disks on a patching level can ruin the disk. The physical disk, of course, will still be in perfect condition; you can always re-initialize it. But that won't be much consolation if you've lost your only copy of an irreplaceable file.

Always use a disk you can afford to ruin. (Once you do that, though, it can

actually be fun to ruin disks and see if you can resurrect them!)

MBPROL.ASM

When assembled and renamed, MBPROL.ASM (Listing 2) will be my PROLOGUE.SYS. I have Fred Hochschild to thank for his article in *REMark* #44 for the elegant method he presented for loading .ABS programs for use as MBASIC USR routines (September 1983, "Learning to Write Assembly Language Subroutines for MBASIC Under HDOS").

Mr. Hochschild's method for loading .ABS programs is simply to put an SCALL .EXIT at the beginning of his program and there it is—in memory—no PEEKs, no POKEs, no hassle. (The entire program is read into memory and run. Then, when it hits the normal .EXIT SCALL, it runs SYSCMD.SYS, which links to MBASIC while leaving the program behind in memory. SYSCMD.SYS (START.ASM) reserves space for this program with the /M: switch when linking to MBASIC.) Read his excellent article for further insights and ideas about machine-language interfacing to MBASIC.

MBASIC allows ten USR calls, numbered 0-9. MBPROL has a jump table at its beginning which allows for these ten. (Actually, other programs can be loaded into reserved memory at the same entry address, giving an unlimited number of possible USR calls from MBASIC. It only falls to you to keep track of which are in memory and when they're there.)

Selection is done by highlighting the names through cursor movement.

The jump table allows all MBASIC USR entrance addresses to remain constant even if the MBPROL code is changed in the future. The FN.n labels in the jump table serve to reserve addresses to be jumped from for added USR functions. By doing this, these entrance points will not change even if code is appended to MBPROL. (Keep in mind, though, that the code should not be much larger than 1K without changing the arguments to the /M: switch. We have about a 300-byte slop factor.)

All addresses used by the MBASIC MENU program are also listed in the .ASM file in decimal. Credit must be given to Stephen E. Auyer for some of the code which I modified for the MENU. (See *Sextant* #7, Fall 1983, "Index Your HDOS Disks.") Others have contributed greatly as sources of published code brought together in this program. (I may not be a good assembly programmer, but I really assemble programs well.) The

Listing 2. MBPROL.ASM, **when assembled and renamed, will become your** PROLOGUE.SYS **file.**

```
        TITLE   'MBPROL.ASM -- MBASIC User routines.'

*       Parts from S. Auyer, SEXTANT # 7 and G. Chandler, REMark # 28.
*       Method of loading suggested by Fred Hochschild, REMark # 44.
*
*       Program entry is 52500 FOR HDOS.
*
*       Incorperates JUMP table at beginning for common entry points
*       from MBASIC program.  Decimal location is noted.
*
*       FN.n are for future additions to source code.  Jumps from these
*       are now to a RET instruction.
*
*       The MBASIC MENU program line 70 tests for 1351 to tell if
*       this program is still in USR area.
*

        LON     G

        ORG     52500                   FOR HDOS ASSEMBLY
.OPENR  EQU     042Q
.READ   EQU     4
.CLOSE  EQU     46Q
.ERROR  EQU     57Q
.PRINT  EQU     3
.EXIT   EQU     0
.CLEAR  EQU     55Q
.DAD    EQU     206Q
.LINK   EQU     40Q
$TYPTX  EQU     31136A
$MOVE   EQU     30252A

EXIT    MVI     A,0
        SCALL   .EXIT

*
*                               JUMP TABLE
*

RN.ABS  JMP     MLINK                   Decimal location 52504.
OP.DIR  JMP     OPEN                       "        "    52507.
RD.DIR  JMP     READ                       "        "    52510.
CL.DIR  JMP     CLOSE                      "        "    52513.
BYEBYE  JMP     BYE                        "        "    52516.
LK.PIR  JMP     PIRATE                     "        "    52519.
FN.6    JMP     NOTYET                     "        "    52522.
FN.7    JMP     NOTYET                     "        "    52525.
FN.8    JMP     NOTYET                     "        "    52528.
FN.9    JMP     NOTYET                     "        "    52531.

*
*                       DRIVE/FILE DESIGNATIONS
*

DEFALT  DB      'SY1SYS'                   "        "    52534.  (36)

FNAME   DB      'SY1:DIRECT.SYS',0         "        "    52540.  (42)

*
*                               BUFFER
*

BUFFER  DS      256                        "        "    52555.

*
*                       FILE NAME WHICH NEEDS STACK ARG.
*
PROB    DB      ' PIRATES.STA',0           "        "    52811.

PROBE   EQU     *-1

PROC    DB      'SY1:PIRATES.ABS',0        "        "    52824.

MLINK   CPI     3
        RNZ
        XCHG
        INX     H
        MOV     A,M
        INX     H
        MOV     H,M
        MOV     L,A
        XCHG
        LXI     H,0                                              ➔
```

```
        DAD     SP
        LXI     SP,42200A
        PUSH    H
        XCHG
        SCALL   .LINK
        POP     H
        SPHL
        RET

OPEN    CALL    CLOSE
        MVI     A,CHAN
        LXI     D,DEFALT
        LXI     H,FNAME
        SCALL   .OPENR
        JC      ERROR
        RET

READ    MVI     A,CHAN
        LXI     B,256
        LXI     D,BUFFER
        SCALL   .READ
        JC      ERROR
        RET

CLOSE   MVI     A,CHAN
        SCALL   .CLOSE
        RNC
        STA     ERRC
        CPI     9
        RE
        LDA     ERRC


ERROR   MVI     H,15Q
        SCALL   .ERROR
        LXI     H,MESSAG
        SCALL   .PRINT
        JMP     EXIT

BYE     MVI     A,0FFH
        CALL    CLOSE
        SCALL   .CLEAR
        SCALL   .DAD
        CALL    $TYPTX
        DB      7,27,'E',27,'Y-0Remove all disks and turn '
        DB      27,'p COMPUTER ',27,'q OFF.',200Q
DONE    JMP     DONE

PIRATE  LXI     H,0
        DAD     SP
        SET     PROBE-PROB+1
        LXI     D,-.
        DAD     D
        SPHL
        LXI     B,PROBE-PROB+1
        LXI     D,PROB
        CALL    $MOVE
        LXI     H,PROC
        SCALL   .LINK
        RET
        JMP     BYE

NOTYET  RET

MESSAG  DB      12Q,'Fatal error - back to system',212Q

CHAN    EQU     -1

ERRC    DS      2

        END     EXIT
```

FN.n jumps mentioned earlier just JMP to NOTYET, a RET instruction; so calls to their addresses will just return to MBASIC.

There is one rather "kludgie" routine in MBPROL. This is the link to Space Pirates (PIRATES.ABS). I wound up needing two separate .ABS link routines: one general-purpose routine, and one specifically for PIRATES.ABS.

When PIRATES.ABS loads and runs, it looks for an argument on the stack—this is the name of the Space Station to be used as its playing screen. Try as I might, I couldn't find or write a routine to work in this situation. So, owing mostly to my lack of assembly-language expertise, this is what I got. All space station names must conform to seven letters plus .STA. So my MENU POKEs a seven-letter name

into memory starting at label PROB plus one byte. (See Listing 3, lines 1010-1050.) (If anyone has any other ideas, let me know.)

Some of the other code may be unusual; some of it is the result of a disassembly of HDOS and is the disassembler's best guess as to what the source is. Comments on these routines can be obtained from the cited articles. Those people are the real programmers.

MENU.BAS

The heart of this set of programs is MENU.BAS (Listing 3). Again, I am indebted to Mr. Auyer for his DIRECT.SYS read routines and filename sort routines, which I modified for use here. As given in Listing 3, the program includes all the spaces for ease of reading. But you may wish to leave them out for speed of execution.

Lines 30-60 set up the program and the '89's terminal functions. Line 40 defines the USR routines' entrance addresses in integer format. MBASIC does not allow non-integer arguments to USR definitions; so 65536 decimal has to be subtracted from all addresses higher than 32767 decimal. (Again, see Fred Hochschild's article in *REMark* #44.)

Line 70 tests the contents of the first ten addresses by figuring a checksum on these contents to verify that MBPROL is still there. An .ABS program might overwrite this portion of memory, and chaos would ensue if MBPROL were not there.

If the checksum is not correct, PROLOGUE.SYS is linked to and loaded back to memory. This is not the best method of testing that MBPROL is still there, but it is probably adequate.

(If you modify MBPROL.ASM, temporarily put

PRINT XX : STOP

after the NEXT X instruction. This will print the new checksum for you.)

The drive which is to be used for the games disk is PEEKed into the program. To do so, MENU goes to the memory location starting at the address of the FNAME label in the assembler .LST file. (This is done so that code could be added to allow the game drive to be changed to another drive.)

Line 80 signs on, and lines 90-110 find FILES.DAT on the game disk. FILES.DAT is an ASCII file which is constructed wholly by the subroutine in lines 620-1000. If FILES.DAT is not found or the game drive is not mounted, error traps are supplied at lines 1070-1100 to recover. If the drive is not MOUNTed, the error recovery routine in 1070 will MOUNT it. If FILES.DAT is not on the disk, this error is found by line 1090 and a FILES.DAT is constructed on the games disk by the subroutine in lines 620-1000.

Lines 120-140 set up the variable array to contain the names of the .ABS and .BAS files. Column lengths for the

Listing 3. MENU.BAS finds the .ABS and .BAS programs on disk, provides a menu of them, and links to the user's selection. This was written and tested under HDOS MBASIC version 4.82. Long lines are shown here extended to more than one physical line by using the at-sign (@). They can also be input as one line if your editor can create lines longer than the width of the screen.

```
10 '  R. L. Streeter's          MBASIC MENU     15-Mar-85                @

20 '     Must be used with the assembly language program MBPROL.ABS      @
         which is renamed as PROLOGUE.SYS, and with START.ABS renamed    @
         SYSCMD.SYS.                                                     @

30 CLEAR 3000 : WIDTH 255 : DIM A$(60),FI$(60) : DEFINT A-Z              @
         : ON ERROR GOTO 1070 : M=5
40 DEF USR0=52504!-65536! : DEF USR1=52507!-65536! : DEF USR2=52510!-65536! @
         : DEF USR3=52513!-65536! : DEF USR4=52516!-65536!                @
         : DEF USR5=52519!-65536!
50 ES$=CHR$(27) : RV$=ES$+"p" : NV$=ES$+"q" : X5$=ES$+"x5" : Y5$=ES$+"y5" @
         : B$=" ":B3$="   " : CA$=ES$+"Y" : CL$=ES$+"E" : BE$=CHR$(7)    @
         : CU$="> " : BT$=ES$+"<"+ES$+"[12D"+ES$+"[?2h"                  @
         : CE$=ES$+"z"+STRING$(40,0)
60 DEF FNC$(X1,Y2)=CA$+CHR$(31+X1)+CHR$(31+Y2) : DATA RESET ,QUIT
70 XX=0 : FOR X=0 TO 9 : XX=XX+PEEK(52500!+X) : NEXT X : IF XX <> 1351 THEN     @
         P$="SY0:PROLOGUE.SYS" : PRINT CL$ Y5$                           @
         FNC$(10,20)"Replacing "P$" into memory!!"; : GOTO 610           @
         : ELSE D$="" : FOR X=0 TO 3 : D$=D$+CHR$(PEEK(52540!+X)) : NEXT X
80 PRINT CL$ : OPEN "I",1,D$+"FILES.DAT" : I=1
90 INPUT #1,FI$(I) : T=INSTR(FI$(I),".") : A$(I)=LEFT$(FI$(I),T-1) : I=I+1
100 IF EOF(1) THEN CLOSE #1 ELSE 90
110 N=I : RESTORE : FOR N=N TO N+1 : READ A$(N) : NEXT N : N=N-1          @
         : A$(N-1)=A$(N-1)+D$
120 PRINT CE$ X5$ ES$+"w" FNC$(1,21) "MENU of programs on disk in "D$"."        @
         FNC$(2,18) STRING$(38,"*")
130 C1=32 : IF N<M THEN N1=N : GOTO 150
140 N1=N\3 : C1=12 : IF N/3<>N1 THEN N1=N1+1
150 PRINT BE$ FNC$(4,1)"Select:" : FOR I=1 TO N1 @
         : PRINT FNC$(3+I,C1) B$ A$(I)B$ : NEXT I
160 IF N1=N THEN 190
170 I1=0 : FOR I=N1+1 TO 2*N1 : I1=I1+1 : PRINT FNC$(3+I1,31) B$ A$(I) B$       @
         : NEXTI
180 I1=0 : FOR I=2*N1+1 TO N : I1=I1+1 : PRINT FNC$(3+I1,50) B$ A$(I) B$       @
         : NEXT I
190 PRINT BE$ FNC$(5+N1,12)              @
         "Use the "RV$" ARROWS "NV$" on the keypad to select from MENU."
200 PRINT@
         : PRINT TAB(24)"Hit "RV$CHR$(34)"ENTER"CHR$(34)NV$" to run selection.";
210 I=1 : J=1 : PRINT FNC$(3+I,C1-2) CU$ RV$ B$ A$(I) B$ NV$
220 Y$=INPUT$(1) : Y=ASC(Y$)
230 IF Y=13 THEN 540 : ELSE IF Y=5 THEN PRINT CE$ : Y=USR4(0)            @
         : ELSE IF Y=21 THEN PRINT BE$ CE$ : GOTO 250 : ELSE 240
240 Y=VAL(Y$) : IF Y=2 OR Y=4 OR Y=6 OR Y=8 THEN 260 : ELSE PRINT BE$;@
         : GOTO 220
250 GOSUB 620 : GOTO 80
260 Y2=Y/2 : J=I : D1=C1 : ON Y2 GOSUB 370,410,450,500
270 IF J>N1 THEN 290
280 PRINT FNC$(3+J,D1-2) SPACE$(12) BT$ B3$ A$(J) B$ : J=I : D1=C1 : GOTO 320
290 IF J>2*N1 THEN 310
300 PRINT FNC$(3+J-N1,D1-2) SPACE$(12) BT$ B3$ A$(J) B$ : J=I@
         : D1=C1 : GOTO 320
310 PRINT FNC$(3+J-2*N1,D1-2) SPACE$(12) BT$ B3$ A$(J) B$ : J=I : D1=C1
320 IF I>N1 THEN 340
330 PRINT FNC$(3+I,C1-2) CU$ RV$ B$ A$(I) B$+NV$ : GOTO 220
340 IF I>2*N1 THEN 360
350 PRINT FNC$(3+I-N1,C1-2) CU$ RV$ B$ A$(I) B$ NV$ : GOTO 220
360 PRINT FNC$(3+I-2*N1,C1-2 )CU$ RV$ B$ A$(I) B$ NV$ : GOTO 220
370 I=I+1 : IF I>N THEN I=N : RETURN
380 IF I<>N1+1 AND I<>2*N1+1 THEN RETURN
390 IF I=N1+1 THEN C1=31 : RETURN
400 IF I=2*N1+1 THEN C1=50 : RETURN
410 IF N1=N THEN RETURN
420 IF C1=12 THEN RETURN
430 IF C1=50 THEN C1=31 : I=I-N1 : RETURN
440 C1=12 : I=I-N1 : RETURN
450 IF N1=N THEN RETURN
460 IF C1=50 THEN RETURN
470 IF C1=12 THEN C1=31 : I=I+N1 : RETURN
480 C1=50 : IF I+N1>N THEN I=N : ELSE I=I+N1
490 RETURN
500 I=I-1 : IF I<1 THEN I=1 : RETURN
510 IF I<>N1 AND I<>2*N1 THEN RETURN
520 IF I=2*N1 THEN C1=31 : RETURN
530 IF I=N1 THEN C1=12 : RETURN
540 IF I=N-1 THEN PRINT CL$ : RESET D$ : PRINT CL$ : GOTO 80
550 IF I=N THEN PRINT CE$ : Y=USR4(0)
560 IF A$(I)="PIRATES" THEN 1010
570 PRINT Y5$ CE$ FNC$(12,18) RV$" Looking for: "FI$(I)" "NV$"--Please wait.";
580 IF RIGHT$(FI$(I),3)="BAS" THEN RUN D$+FI$(I)
590 P$=D$+FI$(I) : PRINT CL$
600 PRINT FNC$(10,22);USR0(P$+CHR$(0));" does not exist!...."BE$ : GOTO 250
610 PRINT FNC$(12,24);USR0(P$+CHR$(0));" is NOT on this disk!"BE$; : Y=USR4(0)
620 PRINT FNC$(12,26)"Updating "D$"FILES.DAT."; : U=ASC(MID$(D$,3,1))
630 POKE 52536!,U : POKE 52542!,U
640 NF=0 : NC=0 : NR=0
650 Y=USR1(0)                                                            →
```

```
660 NF=NF+1:F$=""
670 IF NF>60 THEN 780
680 GOSUB 930
690 IF C=0 THEN 710
700 IF C<>255 THEN 720
710 GOSUB 930 : FOR I=3 TO 23 : GOSUB 930 : NEXT I : GOTO 680
720 F$=F$+CHR$(C) : FOR I=2 TO 8 : GOSUB 930 : F$=F$+CHR$(C)            @
      : NEXT I : F$=F$+"." : IF ASC(LEFT$(F$,1))=254 THEN 770
730 FOR I=9 TO 11:GOSUB 930:IF C=0 THEN F$=F$+" " ELSE F$=F$+CHR$(C)
740 NEXT I
750 FOR I=12 TO 23 : GOSUB 930 : NEXT I : FI$(NF)=F$ : IF INSTR(F$,".BAS")>0    @
      OR INSTR(F$,".ABS")>0 THEN 660
760 NF=NF-1 : GOTO 660
770 Y=USR3(0)
780 PRINT FNC$(14,18)"Sorting files ..... Please be patient."; : NF=NF-1       @
      : M=NF : M2=M
790 M=M\2 : IF M=0 THEN 890
800 M=M OR 1 : J=M+1
810 L=J
820 I=L-M
830 IFFI$(I)<=FI$(L)THEN870
840 SWAP FI$(I),FI$(L)
850 IF I<=M THEN 870
860 L=I : GOTO 820
870 IF J=M2 THEN 790
880 J=J+1 : GOTO 810
890 OPEN "O",1,D$+"FILES.DAT"
900 FOR I=1 TO NF : PRINT #1,FI$(I) : NEXT I
910 CLOSE #1
920 RETURN
930 IF NC>0 THEN 950
940 Y=USR2(0)
950 NC=NC+1 : NR=NR+1 : IF NR<=506 THEN 970
960 NR=0 : NC=0 : GOTO 940
970 IF NC<=256 THEN 990
980 NC=0 : NR=NR-1 : GOTO 940
990 C=PEEK(52555!+NC-1)
1000 RETURN
1010 PRINT CL$ Y5$ FNC$(4,28)"SPACE PIRATES !!!!"                          @
       FNC$(8,6)"Choose your STARBASE:" FNC$(10,29)"1 .. DELTA.IV"         @
       FNC$(11,29)"2 .. BETA.VII" FNC$(12,29)"3 .. CONVOY"                 @
       FNC$(13,29)"4 .. Return to MENU"
1020 PRINT BE$ FNC$(16,20)"Select: | |"CHR$(8) CHR$(8); : Z$=INPUT$(1)
1030 Z=VAL(Z$) : IF Z<1 OR Z>4 THEN 1020 : ELSE PRINT Z$ : PRINT X5$
1040 IF Z=1 THEN Z$="DELTAIV" ELSE IF Z=2 THEN Z$="BETAVII" ELSE IF Z=3 THEN @
       Z$="CONVOYS" : ELSE 120
1050 FOR X=1 TO 7 : POKE(52811!+X),ASC(MID$(Z$,X,1)) : NEXT X
1060 Y=USR5(0)
1070 IF ERR=65 AND ERL=80 THEN RESET D$ : PRINT CL$ : RESUME
1080 IF ERR=53 AND ERL=80 THEN Y=21 : RESUME 230
1090 IF ERR=53 AND ERL=580 THEN PRINT CL$                                   @
       FNC$(10,22) D$ FI$(I) " does not exist!...." BE$ : Y=21 : RESUME 250
1100 ON ERROR GOTO 0
```

menu are computed and format is decided upon depending upon the number of entries in FILES.DAT.

Here also, RESET and QUIT are included among the choices which can be selected by the MENU. RESET is used when a new data disk is to be put into SY1: for more games. QUIT dismounts the disks and operating system and hangs the computer in the "turn computer off" message in the USER routine of PROLOGUE.SYS (MBPROL).

The code which takes care of this is line 110. This line RESTOREs the READ to the beginning of the DATA list in line 60. It then reads these items into the array variables and sets the total number of records to N-1. (The variable N points to the next item at the end of a FOR... NEXT... loop.)

Lines 150-220 print the screen and ask for your selection. Selection is done by highlighting the names through cursor movement rather than pick-a-number.

Lines 230-240 check for valid input and act accordingly. CTRL-E is used as an abort exit from MENU; in the absence of an error, you can update FILES.DAT on the game disk by hitting CTRL-U. This will call up the subroutine at lines 620-1000 to reconstruct the file. Line 230 looks for a 5 (CTRL-E) or a 21 (CTRL-U) as input to branch to these routines.

Line 250 is part of the FILES.DAT update routine.

Lines 260-360 highlight the current selection and maintain proper row and column format.

Lines 370-530 calculate the proper element of the filename array being pointed to by FI$() and by the cursor. Also, some glitches that showed up when I used Mr. Pang's display routine are corrected here. (His program sometimes didn't properly recognize variable sizes of the FILES.DAT file and formatted the screen inappropriately. It also had trouble moving horizontally from column to column at some positions in the display.)

Line 540 processes the RESET command; and line 550 enters the USR4(0) call for QUIT.

Line 560 looks for "PIRATES" and will enter my kludge routine for the link to Space Pirates by a GOTO 1010.

Lines 570-600 look for and RUN an MBASIC program or link to an .ABS program. In case the .ABS file selected is not on the disk, an error code is generated and the name is deleted from FILES.DAT; if it's an MBASIC file name, a GOTO 250 in line 600 directly updates FILES.DAT.

Line 610 is there specifically to tell the user what is happening if a valid PROLOGUE.SYS cannot be found on SY0: and therefore cannot be linked to. The program uses the USR4(0) exit.

A checksum error at line 70 jumps to line 610 to link to PROLOGUE.SYS. If PROLOGUE.SYS is found and the checksum is not correct, the program will recycle through this position indefinitely. (Line 70 may need changing if a major revision of MBPROL is done.)

(See *REMark* #20, Patrick Swayne's

"MBASIC to Machine Code Link Revisited," October 1981, for a complete explanation of the USR routines used in lines 600 and 610.)

Lines 620-1000 break out the filenames from the directory (DIRECT.SYS) looking for only those with .BAS and .ABS extensions, and place them into the FI$( ) array. A sort is then done to alphabetize the array.

Mr. Auyer's routine for finding the end of file (EOF) of DIRECT.SYS had a bug in that it scanned for 254 as indicating the EOF. 254 is the EOF only when it is the first entry of a filename—indicating a never-used filename. But 254 is only used in this manner in DIRECT.SYS after the directory entries for DIRECT.SYS, GRT.SYS, and RGT.SYS. 254 can be found elsewhere, though, most likely in the coded date portion of the directory entry. (The date 30-JUL-83 is coded as 254 by HDOS.) So you would get a false EOF indication. Line 720 corrects this.

Lines 1010-1060 are my kludge Space Pirates routine.

Lines 1070-1100 are error traps. Line 1090 branches to the routine which updates the FILES.DAT file if the selected file is not found. The other traps were discussed previously.

There is one more thing. Under certain circumstances, if SY1: contains just one .ABS or .BAS file and a few with other extensions, the MENU may exit with an "Unprintable Error" at line 890. This can probably be caught by an error trap after line 1090, as follows:

```
1095 IF ERL=890 THEN RETURN
```

This error is unpredictable and very, very rare. (It has only happened once, when I placed a corrupt bootable disk into SY1: by error. I was able to repeat the error with that same disk, but never with another.)

When the user quits a program, the menu will be displayed again.

In summary

I have presented here an integrated MENU program set which can be used for the running of both .BAS and .ABS files through an updatable MBASIC MENU. I have found it to be quite kid-proof and idiot-proof. (In no way do I mean to equate kids with idiots. Kids are much more inventive.)

.ABS programs link to MENU.BAS through an abbreviated SYSCMD.SYS (START) which links to MBASIC and MENU.BAS. Via a special PROLOGUE.SYS (MBPROL), this SYSCMD.SYS sets aside user memory for MBASIC USR routines.

.BAS programs link to the MENU through a simple RUN "MENU" in place of the usual MBASIC END statement.

In conclusion, I feel that even if you don't have any kids or idiots around, or even if you have little use for this MENU, I have presented a combination of programs which may have use in many special user applications. I hope to have whetted your curiosity and appetite.

Ordering Information

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Tektronix Terminal Emulation for Your Z100

This Z-BASIC program lets your Z100 display graphics from a mainframe or other remote computer.

Glenn F. Roberts, Ph.D.

One of the greatest assets of the Heath/Zenith Z100 computer is its high-resolution graphics capability. This is made easy to use by the availability of powerful graphics statements in the Z-BASIC implementation of Microsoft BASIC. There are lots of interesting and useful application programs which can be built around this combination of hardware and software.

This article presents one such application, namely a graphics terminal-emulator program for the Z100. This Z-BASIC program turns the Z100 into a terminal which is functionally equivalent to a Tektronix model-4006 graphics terminal, capable of producing high-resolution graphics when driven by software running on a remote computer.

This article is aimed primarily at Z100 owners who would like to use their computer as a terminal for graphics processing on a mainframe or other remote computer. Nonetheless, the techniques used demonstrate some of the more interesting and powerful capabilities of Z-BASIC and of the Z100 machine.

Those capabilities include: serial communication via the COM1: device; saving and retrieving a screen picture on disk; printing a screen image on a dot-matrix printer; use of the XON/XOFF handshaking protocol in serial communication; and "event trapping," which lets you assign subroutines to be executed when various function keys are hit. These techniques should provide useful ideas to anyone doing advanced programming in Z-BASIC.

Most of us are familiar with microcomputer graphics capabilities to some extent; but it is important to remember that sophisticated computer graphing techniques have been available on large "mainframe" computers for some time. In many ways, the power and flexibility of mainframe graphics software far exceeds the capability of software currently available for microcomputer systems.

That is particularly true in areas involving the processing of large amounts of data. Most mainframe graphics systems such as DISSPLA and SAS-Graph provide support for a wide number of plotting and display devices. One of the most convenient ways to use these packages is by accessing the mainframe computer from a remote location using a graphics terminal, via either a modem or a "hard wired" (network) connection.

A graphics terminal is a special type of terminal which is capable of receiving and understanding specially encoded text which describes a picture—and then interpreting this text as instructions for displaying graphics information on the screen.

I've left plenty of room for improvements.

Levels of sophistication

There are all types of graphics terminals available. The simplest ones use "block" graphics characters to form pictures. This technique is implemented by designing certain graphics characters which fit into one character block (typically an area on the screen of 8 x 10 dots or picture elements—pixels). Since only these predefined patterns are available, these terminals tend to be limited in terms of their flexibility; typically, they cannot produce graphics pictures of very high resolution. The H/Z19 terminal is an example of a terminal using block graphics.

The next level of complexity in graphics terminals includes those which can generate lines (vectors) directly on the screen using their own built-in hardware. These vectors are drawn based on an invisible grid of points which define all of the possible beginning and ending points for vectors.

In order to define a vector, the coordinates of the beginning and ending points are the only pieces of information which need to be transmitted between the terminal and the host computer. This information is transmitted using a special encoding technique which converts coordinate information into ordinary ASCII characters.

Terminals of this type include the model 4006 and 4010 graphics terminals manufactured by Tektronix. It is primarily these terminals I'll be discussing in the rest of this article.

More sophisticated types of graphics terminals exist, of course. Such terminals may include various color capabilities. And the hardware may possibly have shading capability; that is, the ability to fill in an enclosed area on the screen with a color or a pattern.

These more advanced terminal protocols will not be discussed in this article; however, the techniques presented here could be extended to allow emulation of these useful features.

The Tektronix 4006/4010 protocol—graphics

In this article, we will take a close look at the Tektronix Model 4006 and 4010 graphics terminals; and we will develop a program which emulates, or mimics, their behavior.

In order to proceed, we must first develop an understanding of how graphics information is transmitted to these terminals. This is done in a compressed ASCII format; and we refer to this convention as a "protocol." The 4010 and 4006 handle graphics transmission using the same protocol; we will refer to it as simply the 4010 protocol.

The 4010 graphics protocol can handle 1,024 addressable points on each axis. However, only 780 of these points may be displayed in the Y-axis direction—due to the rectangular shape of the screen. The 4010 screen is thus 780 x 1,024 logical points in size. The point 0,0 is considered to be in the lower left corner.

The 4010 can draw vectors on the screen using its specialized hardware; it needs to know only the locations of the vector end points. The 4010 actually draws only from the *current* location to some other point on the screen; thus it

needs to have only *one* point specified.

The vector can be "invisible." This allows you to move to a new location on the screen and begin drawing vectors from that point. Since there are a possible 1,024 (2^{10}) points along each axis direction, the terminal needs to have two 10-bit numbers in order to specify a vector: one for the X endpoint location and one for the Y endpoint location.

Tektronix decided to transmit these two 10-bit numbers five bits at a time; thus there are four parts which define a vector point. For convenience, these 5-bit parts are referred to as HiX, LoX, HiY, and LoY (as shown in Figure 1).

Since the ASCII character set is based on 7-bit quantities, the low five bits can be used to specify the Hi or Lo value; and the upper two bits can be used to identify it as HiY, HiX, LoY, or LoX.

It would thus seem that four ASCII characters must be transmitted to define each vector to be drawn on the screen. This is not quite the case, however, since the 4010 retains the current values of each of the four parts in its internal registers.

With some restrictions, therefore, only the parts which change need to be re-transmitted. The main exception to this rule is that *the LoX value must always be transmitted.* This is necessary because the receipt of a LoX value

		Bytes which must be transmitted			
		HiY	LoY	HiX	LoX
Bytes which change	HiY	X			X
	LoY		X		X
	HiX		X	X	X
	LoX				X

Table 1. Determination of which bytes must be transmitted is based on which bytes change. LoX, however, must always be sent. (See text.)

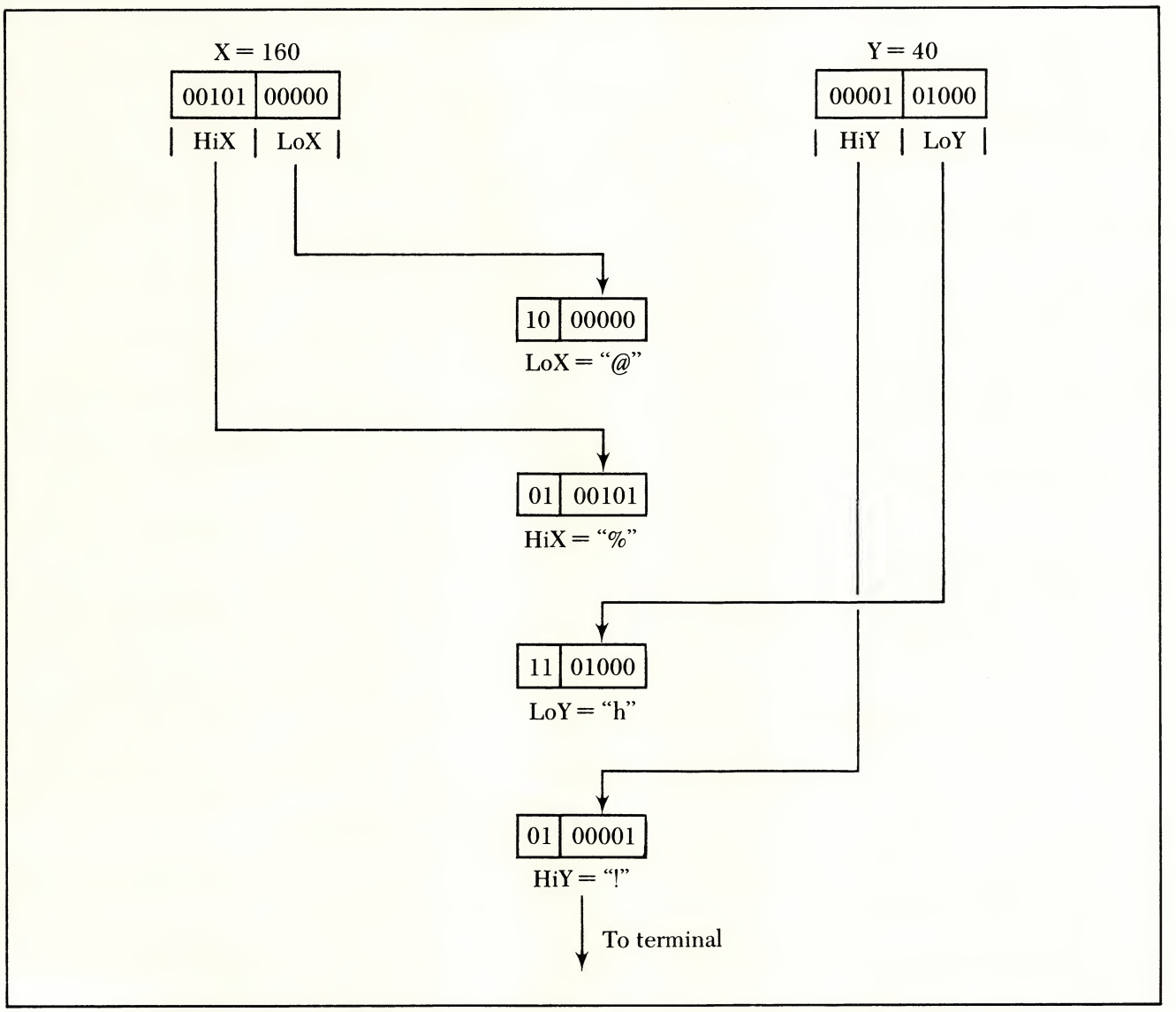

Figure 1. Under the Tektronix protocol, each 10-bit vector coordinate is broken into two 5-bit portions: a "Hi" and a "Lo" portion. These are converted into 7-bit ASCII characters by adding two mode bits to each. These mode bits identify the character as one of the four types, as shown in Table 2.

00 = Control character
01 = High X or high Y
10 = Low X
11 = Low Y

Table 2. The upper two bits of each 7-bit ASCII character determine how the lower five bits are to be interpreted.

causes the terminal to actually draw the vector based on the current values in the four vector registers. All this speeds up terminal operation by reducing the number of bytes that must be transmitted—particularly when drawing right angles where only the X or the Y portion changes.

Table 1 shows which bytes must be transmitted based on which bytes are to be changed.

As noted above, the upper two bits of each 7-bit ASCII character are used to determine how the lower five bits are to be interpreted. The interpretation of these bits is shown in Table 2.

In Table 2, note that if the high two bits are 01 respectively, then the lower five can be either HiX or HiY. How, then, can we tell which is correct?

The answer is given in Table 1. Note that if HiX is to be changed, then a LoY must have been transmitted. Thus, if we have received a LoY value since the last vector was drawn, we can assume this is a HiX; otherwise it must be a HiY.

The 4006/4010 protocol—text

So far, we've discussed only the graphics mode of the 4010. It does, of course, also have a text mode; there, ASCII characters which are received are displayed on the screen in their normal fashion. Special "control" characters are used to switch the terminal between these two modes.

Control characters are simply the first 32 characters of the ASCII character set. These characters are not normally printable, but perform certain functions such as Carriage Return, Line Feed, Form Feed, Backspace, Bell, etc. Since they are the first 32 characters, the high two bits are always zero. Note in Table 2 that such characters are reserved for special control functions in the graphics mode.

The 4010 switches from text to graphics mode when it receives a Group Separator (GS) character (decimal 29). The first vector drawn after receiving this GS character will *always be invisible*; and all four locating bytes must be sent for this first vector.

After that, bytes which do not change do not need to be retransmitted unless they are required, as shown in Table 1. If a GS character is received while the

Listing 1. This Z-BASIC program enables the Z100 to emulate a Tektronix graphics terminal, letting you produce high-resolution graphics with software running on a remote computer.

```
1 '     Tektronix 4006/4010 Terminal Emulator
2 '         For the Z100 under Z-BASIC
3 '
4 '     Glenn Roberts    April 28, 1984
5 '
6 '     This program turns the Z100 computer
7 '     into a Tektronix-type graphics terminal
8 '
10 DEFINT A-Z:
       DIM P!(224):
       DEF SEG = &HE000
11 '
12 '    Character constants
13 '
20     CTRLC = 3:
       FF = 12:
       XON = 17:
       XOFF = 19:
       ESC = 27:
       GS = 29:
       US = 31:
       SPACE = 32
21 '
22 '    Initialization
23 '
30     FALSE = 0:
       TRUE = NOT FALSE:
       GRMODE = FALSE:
       HAVLOY = FALSE:
       A = 0
31 '
32 '    The following constants define the
33 '    communication protocol.  They may
34 '    be modified as needed
35 '
40     BAUD$ = "300":
       PARITY$ = "N":
       BITS$ = "8"
41 '
42 '    Home the cursor, clear the screen
43 '
50     SCREEN 0,0:
       KEY OFF:
       CLS
51 '
52 '    Initialize the array used to index
53 '    bytes for bit image printing
54 '
60 R = 0:
       FOR J=0 TO 392 STEP 16:
         FOR I=0 TO 8:
           P!(R) = (I+J)*128:
           R = R + 1:
         NEXT I:
       NEXT J
61 '
62 '    Assign KEY interrupts to the
63 '    appropriate subroutines
64 '
70 KEY(1) ON:
       ON KEY(1) GOSUB 530
80 KEY(2) ON:
       ON KEY(2) GOSUB 560
90 KEY(3) ON:
       ON KEY(3) GOSUB 590
100 KEY(4) ON:
       ON KEY(4) GOSUB 620
110 KEY(5) ON:
       ON KEY(5) GOSUB 740
120 KEY(6) ON :
       ON KEY(6) GOSUB 470
130 KEY(7) ON :
       ON KEY(7) GOSUB 760
140 KEY(8) ON :
       ON KEY(8) GOSUB 780
150 KEY(9) ON :
       ON KEY(9) GOSUB 800
151 '
152 '   Print heading on screen
153 '
160 GOSUB 620                                    →
```

```
170 PRINT "*** Tektronix 4006/4010 Terminal Emulator ***"
180 PRINT
190 PRINT "Baud   : ";:SCREEN ,1:PRINT BAUD$;:SCREEN ,0
200 PRINT "     Parity : ";:SCREEN ,1:PRINT PARITY$;:SCREEN ,0
210 PRINT "     Bits   : ";:SCREEN ,1:PRINT BITS$;:SCREEN ,0
211 '
212 '   Open serial communications channel as file #1
213 '   and open screen output as file #2
214 '
220 OPEN "COM1:"+BAUD$+","+PARITY$+","+BITS$ AS #1
230 OPEN "SCRN:" FOR OUTPUT AS #2
240 PAUSE=FALSE
241 '
242 '   This is the main execution loop.  First
243 '   check if any characters are in the communication
244 '   buffer, if not then jump.
245 '
250 IF LOC(1)=0 THEN 430
251 '
252 '   Handle "handshaking".  If the communication
253 '   buffer is becoming full, then send an "XOFF"
254 '   character to remote computer to halt its
255 '   transmission and set PAUSE to TRUE to remember
256 '   that the remote is waiting for an "XON".
257 '
260 IF (LOC(1)>80) AND NOT PAUSE THEN PAUSE=TRUE:
      PRINT #1,CHR$(XOFF);
261 '
262 '   Save last received character, then read a
263 '   new character from the communications buffer
264 '   (strip 8th bit if any).
265 '
270 LASTA=A:
      A=ASC(INPUT$(1,#1)) AND 127
271 '
272 '   If character is a control character or if
273 '   we are not in graphics mode then jump.
274 '
280 IF A<SPACE THEN 390
290 IF NOT GRMODE GOTO 420
291 '
292 '   Handle a graphics character.  First put high
293 '   two bits into the MODE variable, then put
294 '   low 5 bits into the BITS variable.
295 '
300 MODE=A\32:
      BITS=A AND 31
310 ON MODE GOTO 320,340,380
311 '
312 '   MODE = 01 (High X or High Y)
313 '
314 '   If we already have a Low Y then this
315 '   must be a High X, else it must be a High Y.
316 '   Shift it over by 5 bits so that Low value
317 '   may simply be added later.
318 '
320 IF HAVLOY THEN HIX=BITS*32
      ELSE HIY=BITS*32
330 GOTO 430
331 '
332 '   MODE = 10 (Low X)
333 '
334 '   The High and Low data is now complete, commence
335 '   drawing the vector on the screen.  Vector is drawn
336 '   using the BASIC statement "DRAW".  Scaling is performed
337 '   by 5/8 in the X direction and 7/24 in the Y direction.
338 '   If vector is invisible add "B" to "blank" it.
339 '
340 Y=15*(780-(LOY+HIY))\52:
      X=5*(BITS+HIX)\8
350 L$="M"+MID$(STR$(X),2)+","+MID$(STR$(Y),2)
360 IF BLANK THEN L$="B"+L$
370 DRAW L$:
      BLANK=FALSE:
      HAVLOY=FALSE:
      GOTO 430
371 '
372 '   MODE = 11 (Low Y)
373 '
```

→

terminal is in graphics mode, the next vector drawn will be invisible.

The 4010 returns to text mode when it receives a Unit Separator (US) character (decimal 31). If it receives the special two-character sequence of an ESCape (decimal 27) followed by a Form Feed (decimal 12), the 4010 will first clear the screen, then return to text mode.

The 4006/4010 emulator program

It is relatively straightforward to implement a program which lets the Z100 emulate a Tektronix terminal. In fact, the entire program can be written in Z-BASIC, the Z100's powerful version of the BASIC language.

Z-BASIC includes statements to control the serial communication port and statements to perform detailed on-screen graphics. These features were not available on the old H8 and H/Z89 8-bit computers running Benton Harbor or Microsoft BASIC; and as such they had to be handled with special device drivers or machine-language routines.

Listing 1 shows the complete emulator program, which is implemented in only 81 lines of BASIC code. The lines containing the actual code are numbered in increments of 10, while the comment lines have line increments of 1.

If you want to type in this program under Z-BASIC, you may use the AUTO command with an increment of 10 (the default). This will prompt you to enter lines 10, 20, 30, etc.

I don't recommend that you enter the comment lines unless you plan to compile the program using the Z-BASIC compiler. The reason for this is that comments will slow down the execution of the program; and speed is a critical factor in a terminal-emulation program.

Note that many of the lines have multiple statements on them (separated by colons). In order to make the listing more readable, I have added Line Feed and Tab characters between these statements. Z-BASIC considers such statements to be on the same *logical* line even though they are listed on separate *physical* lines.

Communications input/output (I/O) is handled using a Z-BASIC COM buffer. OPEN "COM..." will allocate a buffer for I/O just as you would OPEN a disk file. This allows you to treat serial communication in essentially the same manner as file I/O.

The COM1: file is opened on line 220. Note that in the OPEN statement, we must specify the intended communications rate, type of parity checking, and bits per character. These were specified as constants in line 40, where we asked for 300 baud, no parity checking, and 8 bits per character.

The values used here are dependent on the convention used by the remote

computer with which you are communicating. If you work with a number of different remote computers with different conventions, you might want to modify the program to allow you to specify these parameters each time.

For a more complete discussion of the use of COM-buffer files, see the documentation of the OPEN COM statement in the Reference Guide section or see Appendix F of the Z-BASIC manual.

Handshaking

We need next to take care of handshaking; we need a convention for synchronizing the remote computer and the Z100 so that no characters are lost. Since it is written for the Tektronix, the program assumes that the remote computer obeys the XON/XOFF handshaking protocol. It is implemented on lines 260 and 430.

On line 260, the LOC function is used to see if our communications buffer is getting full. If so, then the XOFF character is sent to the remote computer, and the variable PAUSE is set to TRUE to remind the program that it has placed the remote computer on "hold."

Later, after the program has had time to process most of the characters in the buffer, line 430 will check to see whether the communications buffer is nearly empty and PAUSE is TRUE. If so, then it sends the XON character to allow the remote computer to resume transmission.

The program as written must use this handshaking scheme because its effective character throughput is slightly less than the 30 characters per second it will receive at 300 baud.

If the remote computer system which you want to communicate with does not use XON/XOFF handshaking, though, you will almost certainly lose some characters from time to time. You might, then, change the program to incorporate your host computer's handshaking protocol.

Another way to solve the problem is to compile the program using the Z-BASIC compiler. The compiled version is extremely fast at processing characters as they are received; no handshaking is required, at least not at 300 baud.

Graphics processing

The main graphics processing is performed by lines 300 to 410.

When a character is received in graphics mode, the high two bits are placed in MODE, and the low five bits are placed in BITS.

If it's a HiX or HiY (MODE bits are 01), then the BITS portion is shifted left by five bits (multiplied by 32) and placed in either HIX (if a LoY was previously received) or HIY.

If the MODE bits are 11 binary (MODE = 3), then the character is a LoY. The value of BITS is copied to LOY, and HAVLOY is set to TRUE.

```
374 '   Save Low Y value and remember that we've
375 '   received a low Y.
376 '
380 LOY=BITS:
       HAVLOY=TRUE:
       GOTO 430
381 '
382 '   Handle control characters here.  If it
383 '   is a Group Separator (GS) then enter
384 '   graphics mode and remember that the next
385 '   vector drawn should be invisible.
386 '
390 IF A=GS THEN GRMODE=TRUE:
       BLANK=TRUE:
       GOTO 430
391 '
392 '   If it is a Unit Separator (US) then
393 '   exit from graphics mode.
394 '
400 IF A=US THEN GRMODE=FALSE:
       LOCATE (1+Y\9),(1+X\8):
       GOTO 430
401 '
402 '   If it is a Form Feed (FF) and last received
403 '   character was an ESCape, then clear the screen
404 '   and clear the 25th line, then exit graphics mode.
405 '
410 IF A=FF AND LASTA=ESC THEN CLS:
       LOCATE 25,1:PRINT SPACE$(80);:
       GRMODE=FALSE:
       GOTO 430
411 '
412 '   The character is either a normal control
413 '   character or we are not in graphics mode.
414 '   Simply send the character to the screen.
415 '
420 PRINT #2,CHR$(A);
421 '
422 '   If we previously sent an "XOFF" and the remote
423 '   system is waiting for an "XON" then see if the
424 '   communications buffer is almost empty.  If so,
425 '   then send an "XON" character to resume transmission.
426 '
430 IF (LOC(1)<10) AND PAUSE THEN PAUSE=FALSE:
       PRINT #1,CHR$(XON);
431 '
432 '   Now poll the keyboard.  If a key has been hit
433 '   then transmit that character to the remote system
434 '  and loop back to the top of the main loop.
435 '
440 A$=INKEY$
450 IF A$<>"" THEN PRINT #1,A$;
460 GOTO 250
461 '
462 '   Subroutine to print screen using bit image
463 '   graphics on the C.Itoh Prowriter and similar
464 '   dot matrix printers.  (Suggested by Ken Terry
465 '   in REMark Issue #47, P. 50, Dec. 1983).
466 '
470 LPRINT CHR$(14)+CHR$(27)+"["+CHR$(27)+"T17";
480 FOR J=79 TO 0 STEP -1:
       P$="":
       FOR I=0 TO 224:
         P$ = P$ + CHR$(PEEK(P!(I)+J)):
       NEXT I
490 LPRINT CHR$(27)+"S0225"+P$
500 NEXT J
510 BEEP
520 RETURN
521 '
522 '   The following three routines are used
523 '   to save three screen pictures.
524 '
530 BSAVE "SCREEN1.PIC",0,50256!
540 BEEP
550 RETURN
560 BSAVE "SCREEN2.PIC",0,50256!
570 BEEP
580 RETURN
590 BSAVE "SCREEN3.PIC",0,50256!
```

➔

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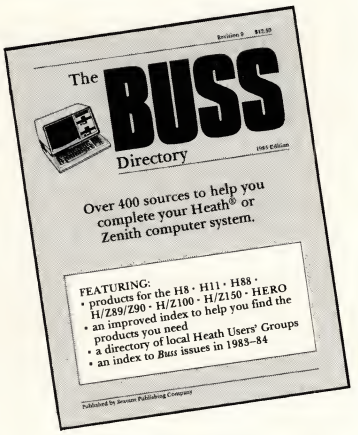

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```
600 BEEP
610 RETURN
611 '
612 '   Subroutine to clear the screen and print
613 '   a reminder prompt on the 25th line.  The
614 '   prompt shows the functions assigned to the
615 '   function keys.
616 '
620 CLS:
      LOCATE 25,1
630 PRINT " 1";:SCREEN ,1:PRINT "SAVE#1";:SCREEN ,0
640 PRINT " 2";:SCREEN ,1:PRINT "SAVE#2";:SCREEN ,0
650 PRINT " 3";:SCREEN ,1:PRINT "SAVE#3";:SCREEN ,0
660 PRINT " 4";:SCREEN ,1:PRINT "CLS   ";:SCREEN ,0
670 PRINT " 5";:SCREEN ,1:PRINT "EXIT  ";:SCREEN ,0
680 PRINT " 6";:SCREEN ,1:PRINT "PRINT ";:SCREEN ,0
690 PRINT " 7";:SCREEN ,1:PRINT "^C    ";:SCREEN ,0
700 PRINT " 8";:SCREEN ,1:PRINT "XOFF  ";:SCREEN ,0
710 PRINT " 9";:SCREEN ,1:PRINT "XON   ";:SCREEN ,0
720 LOCATE 1,1
730 RETURN
731 '
732 '   Routine to cause program execution to end.
733 '
740 CLOSE:
      KEY ON:
      CLS
750 STOP
751 '
752 '   The following three routines provide a way
753 '   to send special control characters.  These routines
754 '   are necessary in the interpreted version since these
755 '   keys are normally "trapped" by ZBASIC.
756 '
760 PRINT #1,CHR$(CTRLC);
770 RETURN
780 PRINT #1,CHR$(XOFF);
790 RETURN
800 PRINT #1,CHR$(XON);
810 RETURN
```

If the MODE bits are 10 (MODE = 2), then the character is a LoX and the vector must be drawn. This is done on lines 340 to 370.

Line 340 rescales the plot coordinates, from the Tektronix system to the Z100 screen coordinate system. The Y coordinates are scaled by 225/780 (which reduces to 15/52); and the X coordinates are scaled by 640/1,024 (which reduces to 5/8).

Note that this scaling is done with *integer* division, which is faster than floating-point division. Note also that the Y coordinate is subtracted from 780. This compensates for the fact that 0,0 indicates the *lower* left on the Tektronix, but the *upper* left on the Z100.

The actual vector generation is done with the DRAW statement. Since the DRAW statement expects a string argument, the X and Y values are converted to the proper string expressions using the STR$ routine.

If the vector is to be "invisible" (BLANK is TRUE), then a "B" is added in the DRAW statement to cause the vector to be blanked.

Handling control characters

Control characters are handled in lines 390 to 410.

A GS character places the program in graphics mode. And it sets BLANK to TRUE, so that the next vector generated will be blanked.

A US character places the program back in text mode; and it locates the text cursor at the X and Y coordinates of the most recently drawn vector. This feature of the Textronix protocol allows text and graphics to be intermixed on the screen.

Line 410 processes an ESCape Form Feed sequence. Whenever a Form Feed character (decimal 12) is received, the program checks to see if the previously received character (saved in LASTA) was an ESCape character. This ESC FF sequence causes the program to clear the screen and return to text mode.

Getting the function keys

A number of useful features have been implemented using the Z100's programmable function keys. Unlike Benton Harbor BASIC and Microsoft BASIC on the H8 and H/Z89 machines, Z-BASIC provides a built-in capability to program the function keys via the ON KEY statement.

That capability allows you to associate subroutines with each of the function keys. Every time a statement is executed, Z-BASIC first checks to see if one of the function keys has been hit. If so,

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Circle #172 on Reader Service Card

Circle #136 on Reader Service Card

Circle #234 on Reader Service Card

then the appropriate routine is executed. This "event trapping" is discussed in Appendix F of the Z-BASIC manual.

Function keys F1–F3 are programmed here to allow you to save screen pictures in disk files. This is done with the BSAVE statement (in lines 530–610) which simply copies bytes from memory to a file. The file names used are SCREEN1.PIC, SCREEN2.PIC, and SCREEN3.PIC respectively.

Bytes are copied to the file beginning at the memory segment defined in the most recent DEF SEG statement. In this example, the memory segment is hexadecimal E000 (line 10 of the program). This is the address of the 64-kilobyte segment of random-access memory (RAM) where the *green* plane is stored.

A simple program to "play back" these screens is shown in Listing 2. This program loads the pictures into memory very quickly since it does not redraw the actual vectors. Instead, it merely fills the video memory with the picture information.

Useful functions are assigned to a number of the other function keys.

Key 4 clears the screen. Key 5 is used to terminate the program. Keys 7-9 provide a means for sending the control characters CTRL-C, CTRL-S (XOFF), and CTRL-Q (XON). The latter features are provided since these control characters are normally intercepted and handled in special ways by Z-BASIC; there would otherwise be no way to transmit them to the remote computer.

Key 6 calls a routine to dump the screen graphics onto a C. Itoh Prowriter printer (or other equivalent printer such as the NEC 8023A). This produces a hard copy of whatever was on the screen. It was first suggested by Ken Terry in *REMark* issue #47, December 1983. (See "Buggin' HUG," page 50.)

I should note that a slight bug shows up with this routine whenever it attempts to transmit a bit-image pattern equal to 00001001 (decimal 9). The printer driver interprets this as a TAB character, and converts it to SPACEs—which leads to an imperfection in the picture.

If that is annoying, you might modify line 480 to change all of the 9's to, say, 8's. This will cause one pixel to be missing once in a while, but will be virtually unnoticeable.

Testing the program

If you type in the program in Listing 1, you should probably test it "off line" before trying it with your favorite mainframe graphics package.

Listing 3 shows a simple program to help figure out what characters would have to be sent by a remote computer in order to produce a given set of vectors defined by their X,Y coordinates. Using this program and the DEBUG utility that comes with Z-DOS, you can create a picture and store it in a file for use in testing the terminal program.

```
1 '    Program to "play back" picture files
2 '
3 '    This program prompts for a file containing a dump
4 '    of the screen contents saved previously via a "BSAVE"
5 '    statement.  The picture is reloaded into video RAM at
6 '    the green memory plane.
7 '
10 KEY OFF
20 CLS
30 DEF SEG=&HE000
40 INPUT "Name of picture file to load ";FILENAME$
50 CLS
60 BLOAD FILENAME$,0
70 BEEP
80 A$=INKEY$:IF A$="" THEN 80
90 CLS
100 KEY ON
```

Listing 2. You may display a screen dump previously saved by means of a Z-BASIC BSAVE statement.

```
1 '    Program to encode graphics data for Tektronix terminals
2 '
3 '    This program may be used to convert a set of X,Y
4 '    coordinates to a string of ASCII characters which would
5 '    generate vectors to those coordinates when received by
6 '    a Tektronix 4006 or 4010 terminal.  To make a vector
7 '    "invisible", precede it's bytes by a GS (hex 1D).  The
8 '    bytes are printed in both hex and ASCII by this program
9 '
10 DEFINT A-Z
20 CLS
30 INPUT "X,Y ";X,Y
40 IF (X>1023) OR (Y>779) THEN
       BEEP:
       PRINT "X or Y off the screen, reenter":
       GOTO 30
50 HIX=32 + (X\32):
       LOX=64 + (X AND 31):
       HIY=32 + (Y\32):
       LOY=64 + 32 + (Y AND 31)
60 PRINT:
       PRINT "(";STR$(X);",";STR$(Y);")  ---------------->      ";
70 PRINT CHR$(34);CHR$(HIY);CHR$(LOY);CHR$(HIX);CHR$(LOX);CHR$(34);:
       PRINT SPACE$(10);:
       PRINT HEX$(HIY);" ";HEX$(LOY);" ";HEX$(HIX);" ";HEX$(LOX)
80 GOTO 30
```

Listing 3. This program asks for a point's X,Y coordinates and calculates the four bytes which represent that point in the Tektronix protocol.

1B	0C	1D	23	64	2C	50	64	32	58	29
6C	58	2E	62	2F	54	29	6C	2C	50	23
64	50	1D	29	6C	50	6C	32	58	1D	23
64	2F	40	25	60	40	60	30	48	23	64
48	1F									

Table 3. The hexadecimal contents of a graphics file (HOUSE.DAT) to be called and executed by the terminal-emulator program in Listing 1. This file can be created under DEBUG by inputting the values shown here. (See text.) It will provide the vector instructions used by the emulator program.

The program in Listing 3 asks for an X,Y coordinate and calculates the four bytes (HiY, LoY, HiX, and LoX) which represent this point; it prints them in both ASCII and hexadecimal. (See Table 1.) In moving from one point to a new one, some of these bytes may be redundant and can be omitted.

The following procedure creates a file called HOUSE.DAT. This will contain the vector instructions to plot a simple picture of a house. The hexadecimal values were calculated using the program in Listing 3. Redundant values have been omitted.

Run the DEBUG program:

```
A:DEBUG
DEBUG version 1.08
>
```

Enter the data in Table 3 by first typing E100 ("Enter" data starting at

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Circle #189 on Reader Service Card

Circle #120 on Reader Service Card

Circle #249 on Reader Service Card

hexadecimal address 100) followed by a carriage return (designated <RETURN>). Then enter the values, each followed by hitting the space bar.

After the last value, simply hit <RETURN>. Now set the CX register to 46 (the number of bytes you entered) by typing RCX <RETURN>; and at the colon prompt, type 2E (the hexadecimal representation of decimal 46).

Then type N followed immediately by the name of the file to write the data to. For example:

NHOUSE.DAT<RETURN>

Finally, write the data to the file by typing W<RETURN> and then exit from DEBUG by typing Q<RETURN>.

You now have a file called HOUSE.DAT which contains the 46 bytes which should define a simple picture of a house.

Now run Z-BASIC and load the Tektronix-emulator program. Replace line 220 with the line:

```
220 OPEN "HOUSE.DAT" FOR INPUT AS #1
```

and make the lines which refer to LOC(1) (lines 250, 260, and 430) into comments by inserting a single-quote character (apostrophe) before them.

Doing so will cause the program to read all input data from the file HOUSE.DAT—instead of from the serial port. When you RUN the program, you should see a simple picture of a house followed by an error message indicating the end of file. If you don't get these results, you probably made a mistake entering the program.

Going further

One of the fun aspects of magazine articles which present programs is that you can customize and improve the program for your own needs. I've left plenty of room for improvements in the simple programs given here.

One improvement in the Tektronix terminal program would be the implementation of a BREAK function. Frequently used in communications systems to stop communication, this is a hardware-based method of gaining the computer's immediate attention. BREAK does not transmit a character *per se* but actually creates a special type of error condition by bringing the communication line to a logic 0 condition for more than one character transmission time. Implementing a BREAK feature would involve some assembly-language interfacing to the the Z100's 2661 EPCI chip.

The compiled version is extremely fast.

Other useful extensions to this program would include emulating one of the Tektronix color-terminal protocols, an interface to a local plotter, or implementation of the 4010 terminal's crosshair feature (which lets you take your cursor to points on the screen and transmit their coordinates).

The program as presented is designed to run with the Z-BASIC interpreter and is therefore limited to speeds of about 300 baud. If you want higher speeds, you can compile it using the Z-BASIC compiler.

I found that the ON KEY statements slowed down the program considerably; therefore, I eliminated them in my compiled version. The reason that they slow the program down is that they cause the compiler to generate extra code to check all of the function keys for every BASIC line (or optionally for every BASIC statement).

Summary

In this article, I have attempted to demonstrate the power of the Z100's hardware and software through an interesting and useful application: a Tektronix graphics terminal emulator. If you work regularly with mainframe graphics packages, as I do, then you now have a tool to turn your Z100 into a useful graphics terminal.

At any rate, I hope you have gained a better understanding of the use of some of the advanced features of Z-BASIC—such as serial communication, the DRAW command, and "event trapping" via the ON KEY statement. △

BASIC Questions and Answers

The ability to mix colors and store LINE commands makes Z-BASIC a versatile graphics tool.

Edward A. Byrnes

I'd like to start using combinations of colors in some graphic pictures I'm working on. How can I mix the colors? And how can I use them as part of a picture?

The easiest way I've found to mix colors is to mix two features available under Z-BASIC: the Z100's graphics-character set; and Z-BASIC's COLOR command, which sets the foreground and background colors.

The graphics equivalent of the lower case "i" is a block where each dot is lit or off in a tiny checkerboard pattern. With COLOR 4,6 set, the dots that are on (foregound) will be red (4) and the dots that are off (background) will be yellow (6). The dots in the pattern are close enough together that the colors mix to give you orange.

Using your colors as part of a picture is equally straightforward. Just fill the screen with the color combination. Now, outline the desired component of your picture with the LINE or DRAW command. Then use the PAINT command with the color 0 (black). This will get rid of the color up to the border of the component you've just drawn.

At this point, you can execute commands for other parts of the picture. Or you can use the GET command to place in memory the picture component you've created. Later, you can use the PUT command to place it back in the picture.

Listing 1 is a program that will fill the screen with any combination of the eight standard colors. By changing the 4 and 6 in line 30's COLOR command to other combinations of values from 1 to 7, twenty-eight other colors can be created. Besides these 36 (the standard colors and combination colors), still other colors can be created.

These "extra" colors are produced by making every third line in a screen of vertical lines a different color. The program in Listing 2 creates a "bright orange" circle with a "normal orange" rectangle to show the difference.

Experimenting with the values in the COLOR command of line 1 will produce different results, and all can be used as colors in components of a color graphic picture.

(For more on mixing colors, you might want to take a look at "Standard Operating Procedure" in *Sextant* #17, July-August 1985, page 106, "Making Z-BASIC More Colorful," by Sidney Hack.)

```
1  REM                 FILL SCREEN WITH UNUSUAL COLORS
10 CLS                 :REM   CLEAR THE SCREEN
20 SCREEN 1            :REM   SWITCH ON THE H-19 GRAPHICS
30 COLOR 4,6           :REM   DEFINE FOREGROUND AND BACKGROUND COLORS
40 FOR X=0 TO 24       :REM   LOOP TO DO LINE 50 AND LINE 60 TWENTY-FIVE TIMES
50 LOCATE 1+X,1        :REM   START AT UPPER LEFT CORNER AND JUMP BY ROWS
60 PRINT "iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
   iiiiiiiiii"         :REM   PRINT FULL ROWS OF THE GRAPHIC CHARACTER FOR 'i'
70 NEXT                :REM   ENDING ARGUMENT FOR LOOP IN LINE 40
80 SCREEN 0            :REM   SWITCH OFF THE H-19 GRAPHICS
90 LOCATE 1,1          :REM   CURSOR BACK TO UPPER LEFT TO AVOID SCREEN JUMP
100 COLOR 6,0          :REM   MAKE FOREGROUND YELLOW AND BACKGROUND BLACK
```

Listing 1. Using Z-BASIC's COLOR command in combination with the graphics-character equivalent of "i", you can fill the screen with any one of 36 colors. Long lines have been broken here for convenience in printing. They can be input as one line if your editor can create lines longer than the width of the screen. Under Z-BASIC, a logical line can be extended to more than one physical line by using the line-feed key (CTRL-J).

```
1 COLOR 4,6:CLS:FOR X=1 TO 639 STEP 1.5:LINE(0+X,0)-(0+X,224):NEXT
2 CIRCLE(320,112),175,0:PAINT(0,0),0,0:SCREEN 1:FOR X=0 TO 5
3 LOCATE 11+X,28:PRINT "iiiiiiiiiiiiiiiiiiiiiiiiii":NEXT:SCREEN 0
4 COLOR 6,0:END
```

Listing 2. Besides the 36 colors which can be produced by Listing 1, additional colors can be created by using sets of three immediately adjacent vertical lines, varying the color of each line. This routine creates a "bright orange" circle with a "normal orange" rectangle inside it.

Is there an easy way to use the LINE statement, other than the LINE(A,B)-(C,D):LINE(C,D)-(E,F) format?

I try to take advantage of Z-BASIC's READ and DATA commands wherever possible. Basically, I try to fill up a series of DATA statements with all the values that I want LINE to take. Then I READ them all at once rather than typing them in. This saves a lot of time and seems to execute faster than the standard LINE commands.

Listing 3 shows how to use READ and LINE commands in combination. The PSET command in line 60 tells the computer where to start the drawing. If you don't use the PSET command, the drawing will begin in the center of the screen.

Another thing to keep in mind is the value in the FOR... NEXT... loop. The "40" in line 70 is the number of coordinate "sets" that are stored in the DATA lines 10 through 50. If the ending argument value in the FOR... NEXT... statement is less than the number of sets in the DATA statements, then the drawing will be incomplete. If the value is larger than

```
1  REM  DRAW A MUSHROOM USING READ DATA STATEMENT
10 DATA 352,92,353,107,355,118,356,129,359,138,338,145,320,142,302,141,308,124
20 DATA 310,115,313,106,312,94,272,91,244,88,223,83,211,78,208,75,207,68
30 DATA 209,65,214,60,228,54,250,47,278,42,305,38,322,37,342,38,402,47,412,49
40 DATA 436,55,452,60,455,64,454,68,450,72,445,77,438,81,425,84,407,87,380,89
50 DATA 352,92,312,94:CLS:REM   COORDINATE STORAGE AND CLEAR SCREEN
60 PSET(352,92)         :REM   DEFINE COORDINATE FOR DRAWING TO BEGIN AT
70 FOR T=1 TO 40        :REM   DO LINES 80 AND 90 FORTY TIMES
80 READ L,J             :REM   READ THE FORTY SETS OF COORDINATES IN DATA LINES
90 LINE -(L,J)          :REM   MAKE LINES ON SCREEN DEFINED BY DATA COORDINATES
100 NEXT                :REM   ARGUMENT FOR LOOP IN LINE 70
```

Listing 3. READ statements can provide the value in DATA statements as the coordinates for LINE commands. This routine produces the outline of a mushroom.

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Version 1.2 includes a dumb "no-eyestrain" 80 by 25 character mode, for logging-on and other activities where Tek mode not needed. Z-100 version provides extensions for color (NOT 41xx compatible), such as automatic different color for text versus graphics. Comprehensive concise manual gets you started quickly. Requires ZDOS/MSDOS/PCDOS 1.1 or above. $129.95

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IBM would like you to think of them when you see 'PCDOS'. Likewise Zenith for 'ZDOS', 'Z-100'.

Circle #186 on Reader Service Card

Photo by Charles Floto

Figure 1.

Photo by Charles Floto

Figure 2.

Photo by Charles Floto

Figure 3.

the number of sets, then an OUT OF DATA error message will appear on the screen.

If you want to use the same set of DATA statements more than once in a program, you must use the RESTORE command before trying to READ them the second or third time.

Reading the Z-BASIC manual, you may get the impression that DATA statements may be placed anywhere in a program. However, I have found it best to place them at the beginning of the program; that way, the computer seems to recognize them as DATA statements quickly. For some reason, I have encountered intermittent SYNTAX ERRORS when I place DATA statements elsewhere in the program.

I've run several of your graphics programs for the Z100. I've noticed that before the final picture is painted, the programs often go through preliminary steps. For example, a figure will be outlined, then filled with color, then repainted, then disappear. Is this preliminary programming necessary, or is it just for show? If it's necessary, what for?

It is usually necessary for the final result. The only time it isn't necessary is when a color has been changed and the command for the original color was not deleted.

As an example of the preliminary programming, say we want a rectangle of "kelly-green" (a mixture of green and black). We want to put that rectangle in memory to use later in a program.

First, we fill the screen with green and black by using commands similar to those in Listing 1.

Then we can use the LINE command in the form LINE(A,B)-(C,D),5,B to use a magenta line (5) to draw the rectangle (B for box). (We could use any other color besides black or green.) Then we could use PAINT(0,0),5,5 to fill in all the background around the kelly-green rectangle with magenta (the first 5), starting at the upper-left corner until it was stopped by the magenta border (the second 5).

Even though we want the rectangle to sit on a solid black background, we can't use black for the border and PAINT color because it is one of the background colors. If we tell the PAINT command to stop at black, it will paint nothing. And if we don't, it will paint the whole screen.

So we fill in around the rectangle with magenta, re-draw the rectangle outline with black, and then use the PAINT command to fill in a black background up to the now black border of the rectangle.

Take advantage of Z-BASIC's READ and DATA commands wherever possible.

Now there is a kelly-green rectangle on a black background. At this time, we can DIMension an array variable, and use GET to place our picture into the array in memory. Once the rectangle is in memory, we clear the screen and proceed with the program.

Listing 4 shows the procedure for placing a cyan-green mushroom over a background of orange and dark red. The outline below is an explanation of the program events as they take place.

1. The screen is filled with cyan-green in line 60.
2. Random circles are placed and painted in lines 70 and 80 for spots on the mushroom. (See Figure 1.)
3. The outline of the figure is drawn in black in line 100.
4. The background is painted black up to the black figure border, line 90.
5. The figure is banished to memory, and the screen is cleared, line 110.
6. To give a background and horizon, the screen is filled with 16 rows of orange, then 9 rows of dark red, lines 120 and 130.
7. In line 140, the outline of the figure is drawn again, in magenta, and painted with magenta. (See Figure 2.)
8. In line 150, the outline of the figure is drawn yet again, with black, and painted black. (This forms a "clear" area for the figure.)
9. The figure is called back from

```
1  REM  MIXED-COLOR MUSHROOM ON MIXED-COLOR BACKGROUND
10 DATA 352,92,353,107,355,118,356,129,359,138,338,145,320,142,302,141,308,124
20 DATA 310,115,313,106,312,94,272,91,244,88,223,83,211,78,208,75,207,68
30 DATA 209,65,214,60,228,54,250,47,278,42,305,38,322,37,342,38,402,47,412,49
40 DATA 436,55,452,60,455,64,454,68,450,72,445,77,438,81,425,84,407,87,380,89
50 DATA 352,92,312,94:CLS
60 SCREEN 1:COLOR 2,3:FOR S=0 TO 24:LOCATE 1+S,1:PRINT "iiiiiiiiiiiiiiiiiiiiiiii
   iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii";:NEXT:SCREEN 0
70 FOR X=1 TO 50:RANDOMIZE VAL(RIGHT$(TIME$,2)):G=(RND*250)+200:F=(RND*100)+40
80 R=(RND*5)+5:CIRCLE(G,F),R,4:PAINT(G,F),4,4:NEXT
90 COLOR 0:GOSUB 100:PAINT(0,0),0,0:LOCATE 1,1:COLOR 6,0:GOTO 110
100 PSET(352,92):FOR T=1 TO 40:READ L,J:LINE -(L,J):NEXT T:RETURN
110 DIM A#(1600):GET(200,35)-(460,145),A#:CLS
120 SCREEN 1:COLOR 4,6:FOR S=0 TO 15:LOCATE 1+S,1:PRINT "iiiiiiiiiiiiiiiiiiiiiii
    iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii";:NEXT:SCREEN 0
130 SCREEN 1:COLOR 4,0:FOR S=15 TO 24:LOCATE 1+S,1:PRINT "iiiiiiiiiiiiiiiiiiiiiii
    iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii";:NEXT:SCREEN 0
140 COLOR 5,5:RESTORE:GOSUB 100:PAINT(300,70),5,5:PAINT(340,120),5,5:COLOR 0,0
150 RESTORE:GOSUB 100:PAINT(300,70),0,0:PAINT(340,120),0,0
160 PUT(200,35),A#:LOCATE 1,1:COLOR 0,0:LINE(312,94)-(324,98)
170 LINE(324,98)-(333,106):LINE(333,106)-(353,127):LINE(353,127)-(359,138)
180 PAINT(340,100),4,0:PAINT(340,100),2,0:COLOR 6,0:END
```

Listing 4. Using Z-BASIC's PAINT command requires you to accommodate for the other colors on the screen. This, in turn, may require you to PAINT an object more than once in order to get your desired result. This routine creates a cyan-green mushroom on a background of orange and dark red. (Long lines were broken here for convenience in printing.)

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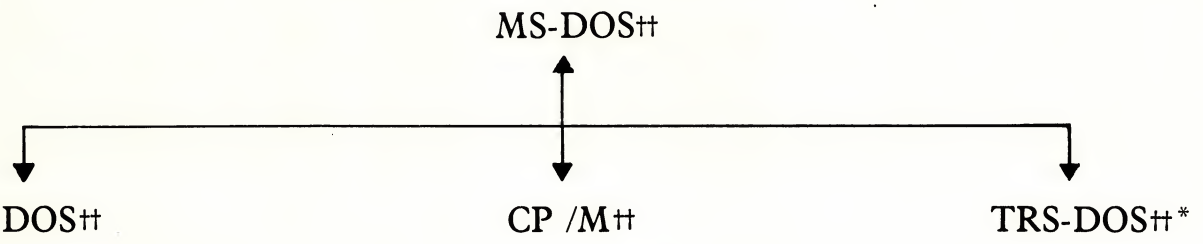

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- Epson QX-10 (DSDD)
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- HDOS (SSDD)
- HDOS (DS00)†
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- Radio Shack TRS-80 CP/M (DSDD)
- Radio Shack TRS-80 CP/M (SSSD)*
- Radio Shack TRS-80 I DOS (SSDD)*†
- Radio Shack TRS-80 DOS 1.3 (SSDD)*†
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- NEC PC (8001) (SSDD)
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- Televideo (SSDD)
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- Zenith Z-90 (DSDD)
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Circle #210 on Reader Service Card

memory and PUT in the black or "clear" area, line 160.

10. A line for a shadow on the stem of the mushroom is drawn. The shadow is painted red, then painted green, in lines 170 and 180. (See Figure 3.)

The Z-BASIC Manual tells me that I can use BLOAD and BSAVE to store and present graphic displays. I've used the programs in the manual, but the results are disappointing. What I get is a half screen of graphics and only in the color green. What is happening?

To BSAVE an entire screen display with all the colors, you must BSAVE the green, red, and blue "planes" where the colors are stored in memory. You must also give up 192 kilobytes of disk space. Placed at the end of a program which produces a graphic display, Listing 5 will save the green, red, and blue planes.

In Listing 5, DEF SEG= defines the segment to be used by BSAVE; that is, it points at the beginning of each color buffer. Each plane is then saved, green as PIC1, red as PIC2, and blue as PIC3. On my machine, using anything less than 64000 as the buffer length will return just a fraction of the screen upon a subsequent BLOAD. You can also use extensions when naming the picture files; for example, PIC1.PCT can be used in place of PIC1.

Once you use BSAVE to create the picture files, BLOAD is used to redisplay the graphic pictures. The program in Listing 6 will display any graphics previously saved with the program in Listing 5.

The screen does not have to be cleared first, since the BLOADed picture file clears the screen as it scrolls from top to bottom. When the program in Listing 6 is executed, the green image scrolls onto the screen, then the red, and finally the blue. Combinations of these colors produce the other colors that may be a part of the original picture. When the program is finished, an exact duplicate of what was previously BSAVEd is displayed on the screen.

Do you have any questions about programming in BASIC? If so, send them to:

Edward A. Byrnes
BASIC Questions and Answers
412 Taylor Street
Rochester, MI 48063–4327

```
10000 DEF SEG=&HE000:BSAVE "PIC1",0,64000
10010 DEF SEG=&HD000:BSAVE "PIC2",0,64000
10020 DEF SEG=&HC000:BSAVE "PIC3",0,64000
```

Listing 5. In saving a color picture, at least 64 kilobytes must be set aside for each of the three color planes—red, green, and blue.

```
05 REM ******PICMAKER.BAS*******
10 DEF SEG=&HE000:BLOAD "PIC1",0
20 DEF SEG=&HD000:BLOAD "PIC2",0
30 DEF SEG=&HC000:BLOAD "PIC3",0
```

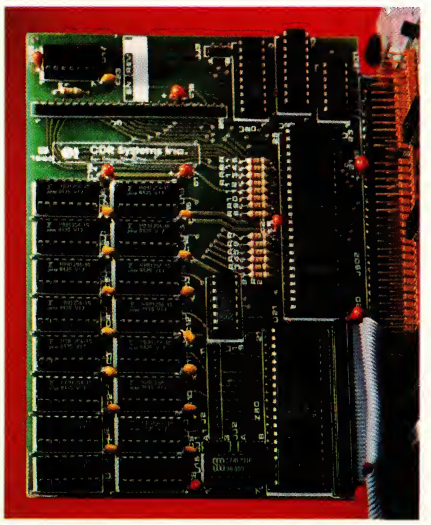
Listing 6. This routine will display any graphics previously saved with the program lines in Listing 5.

Wondering how many issues are left on your subscription?

```
0.00  2235 1SEP 57 -->25
```

The rightmost number in the top row of your address label indicates the last issue on your subscription. In the sample above, the last issue number is 25, indicating that the subscription ends with the November-December 1986 issue of *Sextant*.

Supplier Notes



Add a Megabyte of RAM to Your '89

Super RAM 89 from C.D.R. Systems adds up to one megabyte of random-access memory (RAM) to the H/Z89-90. C.D.R. reports that depending on the software being used, programs using the additional RAM as a pseudo-disk drive may run up to ten times faster than with standard floppy-disk drives.

The Super RAM 89 package includes two boards which plug into the left side of the '89. Each board has two banks, each of which will accept 256K of RAM chips. (Any of the banks may alternatively be used for 64K of RAM.) Board 2 also includes a real-time clock and SASI-interface hardware capability to support a hard disk. Board 2 attaches piggyback to Board 1. The boards may be purchased separately, and Board 1 may be used alone.

Super RAM 89 comes with RAM Drive, software which allows the use of the additional RAM as one or two logical drives. The drives may be given any letter identification from A: to O:. When set to drive A:, the computer will warm boot without floppy-disk access. The RAM Drive software runs with all versions of CP/M 2.2 used in the H/Z89-90.

For details, contact C.D.R. Systems, Inc., 7210 Clairemont Mesa Boulevard, San Diego, CA 92111, 619/560-1272.

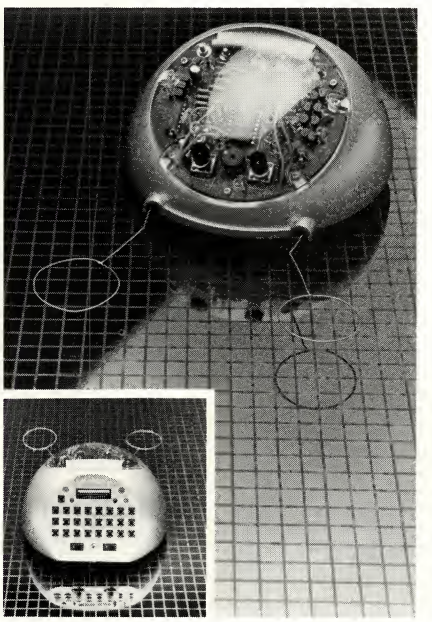
WAO Kit Introduces Robotics, Programming

WAO (Wise Argent Orb) is a new electronic robot kit from OWI, Inc. The robot is designed to teach fundamentals of computer programming, to create graphics, and to serve as an introduction to robotics.

WAO contains a microcomputer chip with a system program stored in ROM (two Kbytes). The chip permits a user program as long as 128 four-bit commands to be stored in RAM.

A penholder in the center of its mechanism allows WAO to draw graphics by moving over a piece of paper. For communication with personal computers, software and a connector are sold as optional items; these will be available soon for IBM-compatible computers such as the Z150.

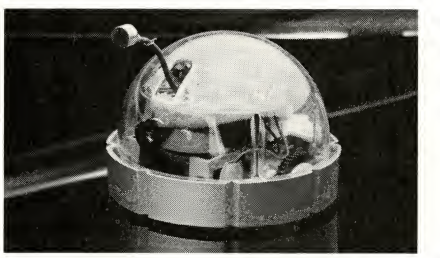
Suggested retail price is $99.95. For more information, contact OWI, Inc., 1160 Mahalo Place, Compton, CA 90220, 213/638-4732.



Sound-Activated S-Cargo Crawls on Command

Movit S-Cargo is a sound-sensor robot kit controlled by a condensor microphone and printed-circuit board. A hand-held sound activator may be used to command the S-Cargo to rotate left, to move forward, and to stop.

Suggested retail price is $39.95. One 9V and two "AA" batteries are required (not included in the kit). For more information, contact OWI, Inc., 1160 Mahalo Place, Compton, CA 90220, 213/638-4732.



Protect Your System From Static Damage

Zenith Data Systems has put together a set of products designed to protect small computer systems from damage caused by static electricity.

The Stat-Attack package includes several products which dissipate static discharge, including a spray which may be applied directly to computer equipment, carpets, and countertops. An anti-static monitor screen and keyboard cleaner and an anti-static cabinet cleaner protect equipment from static and remove dust, dirt, grease, and other deposits. Lint-free cloths and swabs are provided for applying these cleaners.

Also included are an anti-static hand lotion and a dusting gas to spray away dust and loose particles from equipment.

For more information, contact your local Heath/Zenith Computers and Electronics Center or Zenith Data Systems dealer.

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Luminaries

Kenneth W. Daniel is a research engineer at the Washington, D.C., office of the Environmental Research Institute of Michigan. When he applies his research talents to the word-processing environment, the results are quite thorough.

Kenneth A. Patrick is not new to Heath/Zenith product reviewing. He's surveyed spreadsheet and print-spooler alternatives in earlier issues of *Sextant*. And he's constantly evaluating products for Tex-Matics Micro Systems, his computer store and consulting business in Plano, Texas.

Wayne Rash, Jr., is a Z100 and Z150 user and a man on the move. We don't know whether he'll be carrying a '160 with him on future trips or if he'll wait for a newer model from Zenith. For what it's worth, though, he will be reviewing one of the newer models for *Sextant*.

Glenn F. Roberts, Ph.D., is a computer and systems engineer at a research lab in Falls Church, Virginia. It's encouraging for the rest of us that someone who does this for a living found a simple solution in Z-BASIC to a seemingly complex problem.

Dennis Shackleton is a chief electronics technician in the U.S. Navy. He teaches maintenance for the computer equipment carried on submarines. His job must be very exciting if he reads BIOS listings for recreation.

Rick Streeter is a Minnesotan dentist whose "vocation is necessary to support his avocation"—programming. Most of the programming he does is modification of game and utility software to fit his own criteria. Hence his MENU program, a combination of the two.

To get in touch with your fellow Heath/Zenith users, place your short notice in *Sextant*'s classified section. The rate is only 75¢ per word with a minimum of 15 words. Send your typewritten ad and payment to: Sextant, Classified Ad Department, 716 E Street, S.E., Washington, DC 20003. Please include your name and phone number for our records. Deadline is September 18 for the November-December issue, and November 13 for the January-February 1986 issue.

Scuttlebutt

Flash news bulletin on D.E.L.'s **Gemini board**: ZDS's on-again, off-again negotiations for the board are **on again**. Zenith tested 55 IBM PC-DOS programs on a recent version of the board. They all ran, although minor color and speed changes were noted in some programs.

Zenith has reportedly ordered **20,000 boards to install in Z100s** until the end of their contract with the Federal government. These "upgraded" machines will be available to purchasers under the government contract **at no extra charge**, except for the cost of the PC-DOS operating system.

Zenith will also reportedly be selling D.E.L. the same ROM chips they use for the Z150's BIOS, helping the Gemini board toward the '150's high level of PC-compatibility.

ZDS's decision to include the Gemini board in the government contract means that there probably will be **a shortage of boards** available for non-government purchasers.

A Z100 with hard disk was involved in a fire at the Officer's Club at Bolling Air Force Base recently. The '100 was **"black and grungy,"** according to one observer, and the screen had to be scraped off before the machine could be checked out. But **it worked perfectly**, hard disk and all. So what's all this fuss about "ruggedizing" Z100s?

The first issue of ***HeroTracks: The Independent Guide to the Hero Robots*** will be out in September. Charter subscriptions are available for $19.50 per year (12 issues). For more information or to subscribe, write to *HeroTracks*, 4734 East 26th Street, Tucson, AZ 85711. (Visa, MasterCard, money order, and checks accepted, payable to CompuSystems Management.) They're also looking for writers; for author information, send a self-addressed, stamped envelope with 44¢ postage to the above address.

Zenith Electronics Corporation has acquired **Inteq, Inc.**, the firm that developed the technology used by Zenith in the Tempest Z150. The Tempest design prevents the computer from emitting electromagnetic radiation from which information can be picked up.

We reported here in the March-April issue that **Lotus Development Corp.** was unwilling to drop their copy-protection on Lotus 1-2-3 to fit the Navy's requirement for **non-protected software**. This meant the loss of a multi-million-dollar contract.

In the grand tradition of Coca-Cola, Lotus has **changed its mind**. They will not copy-protect the version of 1-2-3 to be sold under Zenith's Tempest contract.

ZEC reported a **second-quarter loss** for 1985, which they attribute largely to heavy competition in the color television market. Revenues for the computer systems and components division were up, though, with sales of computer products 59% higher than in the same period last year.

Robert P. Dilworth has been named president of Zenith Data Systems. Dilworth succeeds Carl Michelotti, who will continue as corporate senior vice president of Zenith Electronics Corporation, ZDS's parent company.

Dilworth comes to ZDS from **Morrow Designs Inc.**, whose Pivot laptop computer Zenith has repackaged as the Z171. Does this mean that when ZDS acquires technology from another firm, if they can't buy the firm they'll settle for its president?

Once again, **regional HUG conference season** is upon us:

The **Capital Heath Users' Group Conference** will be held on two days this year, November 2 and 3, at the Crystal City Hyatt Regency Hotel in Arlington, Virginia. (This is the same location as last year's CHUG conference.) For more information, write CHUGCON 85, P.O. Box 10515, Alexandria, VA 22310, or call 703/339-9857 for a recording machine with a message.

The **Western Regional HUG Conference** will be held at Disneyland again, the weekend of November 15-17. For more information, see their ad on page 99 of this issue.

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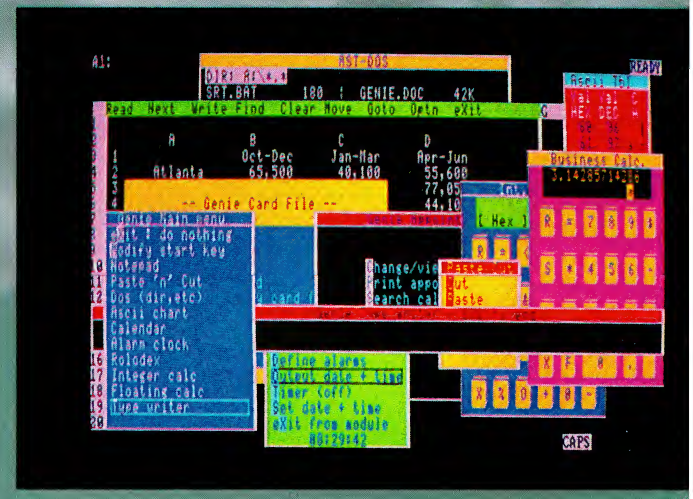

Shown here is Genie "popped up" on a Z-110 running Lotus 123. From the left are: The Genie main menu, the Genie rolodex style card file, the Genie notepad containing data cut from Lotus, the Genie DOS performing a directory command, the Genie alarm clock (at the bottom,) the Genie typewriter, Genie calendar, Genie Cut and paste, Genie Calculators, and the Genie Ascii table.

Genie

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Key Macros	+69.95	No	**YES**
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Notepad	50K	4K	**No Limit**
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Calendar	Yes	Yes	**YES**
Rolodex	Yes	No	**YES**
Cut and Paste	No	No	**YES**
Alarm	No	Yes	**YES**
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